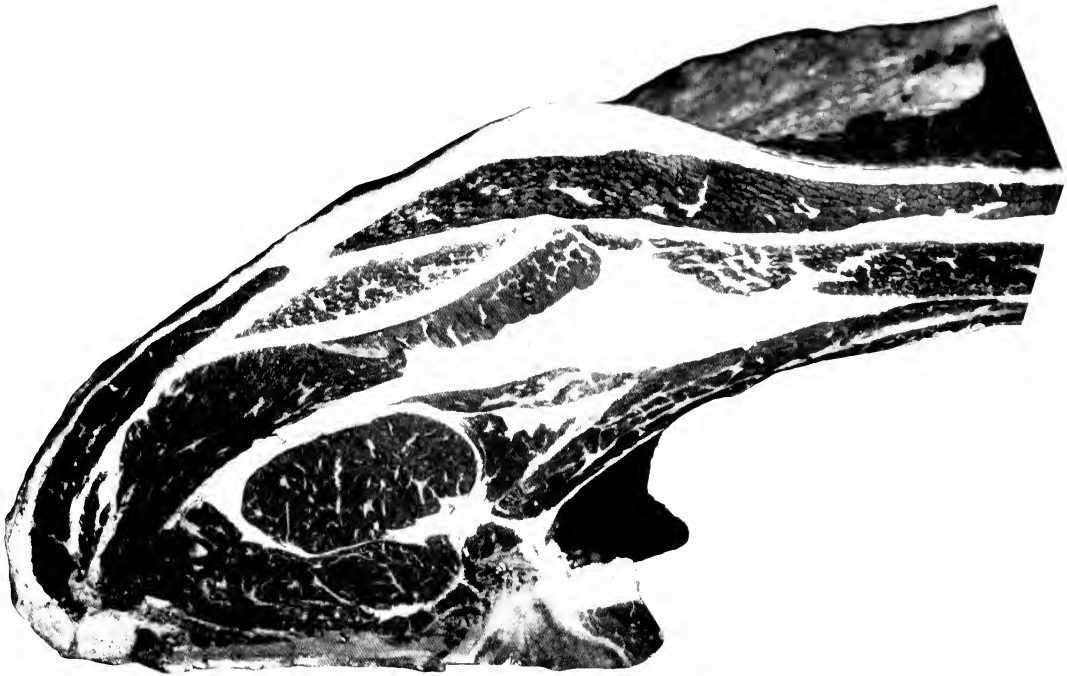

This is the meat I would eat were I going to do battle with any mortal foe. Fancy a hundred thousand Englishmen, after a meal of stalwart beef ribs, encountering a hundred thousand Frenchmen who had partaken of a trifling collation of soup, turnips, carrots, onions, and Gruyére cheese! Would it be manly to engage at such odds? I say no.—Wm. M. Thackeray.

BEEF PRODUCTION

BY

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"Beef is the imperial flesh food of the race."—KERRICK

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PREFACE

The magnitude and importance of the production of beef as a factor in American agriculture are not generally appreciated. The presentation of a book devoted solely to a discussion of the problems of the beef producer is an attempt to give adequate recognition to the industry.

In "Beef Production" the attempt is made to present in the most direct manner certain facts of great economic importance to American beef producers. Much of the information given is based upon extensive feeding experiments conducted by the author at the Illinois Experiment Station. The arrangement of matter is designed to suit the demands both of the actual cattle feeder and of the student; to serve both as a ready reference guide — a text adapted to the progressive pedagogic presentation of the subject in the classroom and a treatise conveniently arranged in logical order for the general reader interested in the subject. The writer fully appreciates that the work is not as complete and comprehensive as it might be made; it is presented, however, with the thought that it will contribute to the literature, especially on the economic side, of beef production. It is hoped that it will serve to make beef production more profitable. The writer wishes to gratefully acknowledge the valuable suggestions and assistance given in the preparation of this book by his associate, Mr. L. D. Hall.

HERBERT W. MUMFORD.

URBANA, ILL., January, 1907.

BEEF PRODUCTION

PART I.

FATTENING CATTLE FOR THE MARKET

CHAPTER I.

THE RELATION OF CATTLE FEEDING TO SOIL FERTILITY

More extensive operations in cattle feeding can consistently be urged upon farmers in general from the standpoint of maintaining or improving the fertility of the soil. It may be argued that other classes of live-stock, horses, sheep, and hogs, may be fed with greater profit. This may be granted where conditions are especially favorable to these interests, but it must be admitted that it is difficult, if not indeed impracticable, to keep sufficient hogs to furnish the desired amount of fertilizer. Then, again, cattle consume certain by-products of the farm that are difficult to convert into pork or bacon, mutton, or horse flesh. The feeding of cattle with hogs as an adjunct seems a logical solution to the conversion of farm products into cash meat products, furnishing at the same time a valuable machine for the manufacture of farm yard manure. Cattle feeding does not necessarily mean the exclusion of other classes of live stock on the farm.

The animal husbandry department of the Illinois Experiment Station has repeatedly stated in its bulletins that it believes that the manure produced by fattening steers will balance the expense of labor in caring

for the cattle. This, we believe, is true, yet such a statement is not sufficiently definite to meet the requirements of this discussion. The writer appreciates how extremely difficult it is to determine the agricultural value of farm yard manure, but there is, fortunately, sufficient data at hand to throw some light on this intricate problem.

Director Charles E. Thorne of the Ohio Station has published the most valuable data concerning the use and value of farm manures of which the writer has knowledge. In this connection the reader's attention is called to Circular 54 of the Ohio Station at Wooster, from which many of the facts used in this paper are quoted. From unpublished records at the Ohio Station, Director Thorne writes me that the average daily production of manure for a thousand pound steer (records secured from weighing the manure from 106 steers for an average period of five months) amounted to forty pounds in one instance and forty-six pounds in the other. Seven pounds of these amounts was straw used for bedding. In other words, the normal production of manure from a thousand pound steer varied from three to four tons for a feeding period of six months. The same authority states that "a ton of average mixed farm manure, as taken from open barn yards, may be expected to contain nine pounds of nitrogen, ten pounds of potassium, and three or four of phosphorus." Professor Thorne states that "when properly cared for and properly balanced, the nitrogen, phosphorus, and potassium in such manure are as effective, pound for pound, as those in the best fertilizing chemicals." And again: "As the cereal crops approach maturity there is a partial separation of their chemical constituents, the nitrogen and phosphorus accumulating in the grain until about three fourths of that held by the entire plant is found there, while the straw or stover contains the major portion of the potassium. Hence, when the grain is sold it carries away from the farm an undue proportion of

phosphorus and nitrogen, and there will in time result a deficiency of these elements in the soil as compared with potassium unless the supply of this also is reduced by the selling of hay and straw, or of leafy plants, such as tobacco. If mixed farming be practiced, including the growing and fattening of live stock, most of the potassium will be retained on the farm; but there will still be a heavy loss of phosphorus in that carried away in the bones of animals grown on the farm." It might be added in this latter instance that the older and more mature the animals fed the less will be this loss of phosphorus. This indicates that many soils under average conditions require more phosphorus in proportion to nitrogen and potassium than that contained in manure. In other words, to make farm yard manure well balanced, phosphorus in some form should be added to it. This is done by the use of acid phosphate, steamed bone meal, or finely ground phosphate rock.

MANURE TESTS IN OHIO

At the Ohio Station under Professor Thorne's direction tests of farm yard manure have been running for nine years, in which it was used in different rotations, both alone and in combination with some carrier of phosphorus and other elements. Eight tons of manure per acre was the standard application. The average yearly increase per acre of this one application in a three-year rotation of corn, wheat, and clover was for the untreated manure 14.70 bushels of corn and 744 pounds of stover, a money value of $7, figuring the corn at 40 cents per bushel and the stover at $3 per ton. For the wheat following the corn the increase for the untreated manure was 8.36 bushels of wheat and 897 pounds of straw, representing a money value of $7.58, figuring wheat at 80 cents per bushel and straw at $2 per ton. For the clover following the wheat the increase in yield for the manured plot was at the rate of 686

pounds, representing a money value of $2.74, figuring the hay at $8 per ton.

Summarizing, then, we may say that the application of eight tons of farm yard manure increased the crops of corn, wheat, and clover in rotation representing a money value of $17.32, or $2.17 per ton. This value was determined for yard manure that had lain in the open through the winter. The value of stall manure that had been kept under cover during the time it was accumulating until a short time before application was $23.61 for the eight-ton application, or $2.95 per ton.

WHAT AN ILLINOIS AUTHORITY SAYS

Dr. C. G. Hopkins of the Illinois Station is authority for the statement that the value of farm yard manure comes not only from the elements of plant food which it may contain, but also and sometimes chiefly that the decaying organic matter of the manure liberates quantities of plant food already in the soil and adds humus, which may or may not, according to the character and previous treatment of the soil, add considerably to its value. By balancing the stall manure by the addition of a carrier of phosphorus the value of the eight tons of such manure was increased $12.20, or $1.53 per ton, and this after deducting the cost of the material used for balancing the same. Adding this to the untreated stall manure we have $2.95 plus $1.53, which equals $4.48 as the possible net agricultural value of the phosphated farm manure as applied to the soil at the Wooster Experiment Station, where the soil is a sandy clay loam. It should be clearly understood that more than one-third of this value is due to the addition of phosphorus, and it may be stated that practically the same increase was made whether the phosphorus was applied as acid phosphate, costing 30 cents, or as finely ground natural rock phosphate, costing 16 cents, to the ton of manure. The power of farm manure to liberate mineral plant food from the soil applies with

equal or greater force to the liberation of phosphorus from the insoluble rock phosphate when applied in connection with manure.

When we remember that the production of manure of the 1000 pound steer for a six-months' feeding period varies from three to four tons, we can appreciate what a factor farm yard manure may become in increasing the revenues of the farm and that profits and losses in cattle feeding should not stop with a consideration of the cost of cattle and feed and their selling price.

CHAPTER II.

GENERAL CONSIDERATIONS IN BUYING FEEDING CATTLE

There is always that first consideration as to whether or not the farmer should buy cattle to feed. This is a very important question, and the correct answer to it depends upon so many factors that it will seldom be answered twice alike. One thing is certain, it is always wise to be conservative in considering cattle feeding propositions. In general it would seem good practice not to buy cattle to feed unless the larger part of the corn and roughage necessary for finishing are available from products grown on the farm. Profits in cattle feeding, while not always denied to the man who is obliged to purchase corn, other concentrates, and roughages, are necessarily smaller than to the feeder who produces his feeds, provided, of course, the same methods and intelligence obtain in each instance. This is the chief advantage of the corn-belt cattle feeder over his less fortunate brother farmer outside the corn-belt. As to the amount of corn and roughage required to finish a steer, much depends upon the supplementary feeds and the kind and quality of roughage used with corn. The age and condition of the feeding cattle and the method of feeding also have a direct bearing upon the amount required.

Taking, however, an average instance, namely, the finishing of a 2-year-old or older steer of the choice grade weighing 1000 pounds, fattened in six months from purchase, when the ration is corn and a good quality of clover or alfalfa hay, 55 to 66 bushels of corn and one ton of hay will be required. If the corn is supplemented with some nitrogenous supplement, like oil meal

or cottonseed meal, slightly less corn will be needed. If other roughages than clover and alfalfa are used, such as corn stover and straw, then less clover will be required. If cattle are on grass the acreage required will depend upon the extent to which grain is fed and the quality of the grass. Knowing approximately the amount of feed produced that is available for feeding cattle, the feeder is thus in a position to know about how many cattle he can feed advantageously.

In regard to the number the cattle feeder should feed, the writer wishes to emphasize the fact that cattle feeding is a business that lends itself most advantageously to extensive practice and methods. In other words, the cattle feeder who does not feed at least a carload is greatly handicapped when it comes to selling — so much so that we do not advise the finishing of cattle in less than car lots. This same thought carried a little further means that the cattle feeder who is in a position to feed even more than one carload has a distinct advantage over the one-carload feeder. As a rule, he saves on freight, labor, and purchased feeds. Further than this, he has an opportunity to more evenly grade his cattle to the advantage of the more timid and smaller cattle in the feed lot. Again, some cattle finish more quickly than others, and the extensive feeder has the opportunity to select a load of this kind and market them as soon as they are ready. The one-load feeder is likely to have one or more steers that are not finished, a few that may be considerably fatter than the majority, enough so, at least, to make the load look uneven, and, as a result, sell unsatisfactorily.

Successful beef production usually comes as a reward to those who have made a close study of the business and have pursued it sufficiently long to render them keen to take advantage of every favorable opportunity that presents itself, whether it be drought or flood, for buying to advantage. They aim to buy when, for whatever reason, they can get the best quality for the least money.

They frequently buy something a little different from their choice because of circumstances that render another grade or condition of cattle manifestly cheaper. No two seasons are precisely alike, hence the successful cattle feeder is resourceful and far-seeing.

In addition to the question of soil fertility already discussed, the conditions most likely to influence farmers to feed cattle are: large crops commonly used in finishing cattle, especially when the cash market for such products rules low; high prices for fat cattle; low prices prevailing for stockers and feeders; and the prosperity of neighboring cattle feeders.

In some ways, all of these are treacherous guides to follow. If abundant crops are followed by correspondingly cheap corn and roughage, cheap gains are assured where these feeds are administered by intelligent hands. Cheap feeds, however, have a tendency to create an abnormal demand for stock and feeding cattle as a result of which, prices for such stock are apt to rise — at times above a point where the cattle feeder can afford to handle them. Notwithstanding this fact, more cattle are put on feed at such times than usual, and, because of the cheap feed, there is a tendency for feeders to hold longer and make them better.

The inevitable result of an abundant supply of well finished beeves is to cheapen them, so that when feeds are abundant and relatively cheap the cattle feeder must guard against buying them at prohibitive prices, and with the feeling that prices at such times are more likely to go lower than higher. Whether or not prevailing low prices for stockers and feeders should be a potent influence in determining the extent of cattle feeding operations will depend largely upon the general status of the cattle industry, business conditions, and probable price of feeds.

Of all the hazardous guides followed by the prospective cattle feeder, that of the prosperity of a neighbor feeder is most hazardous. Farmers unaccustomed to

fattening cattle have seen a neighbor make money in the business for three or four consecutive years and conclude that they too can do likewise. Quite often the next year and the next prove unfavorable for the cattle feeder, and the beginner, confronted with this obstacle in addition to his lack of experience, loses considerable money that he can ill afford to lose. Many well-informed cattlemen make it a rule to feed a certain number of cattle each year without much regard to changing conditions. This seems the safer rule, provided conditions are not such as to make it possible to know at the outset that the business can not be engaged in without loss. Certain it is that such a policy is far wiser than one which involves going in and out of the business with an effort to follow market and other conditions.

WHEN, WHERE, AND HOW TO MAKE PURCHASES OF FEEDING CATTLE

If we were able to make a definite statement as to when, where, and how to buy feeding cattle that could be followed in all seasons and under all conditions, we know the information would be of inestimable value to the cattle feeders of the country. Experienced cattle feeders understand, however, that such statements, if made at all, would need to be qualified by many exceptions. No attempt will be made to give rules for the guidance of buyers of feeding cattle, but rather some of the more important factors affecting these questions will be discussed sufficiently to make it possible for the individual to come to an intelligent decision in these matters after becoming thoroughly familiar with local and market conditions.

WHEN TO BUY

The best time to buy is when the cattle can be bought the cheapest, all things considered. This is easily said, but it is, indeed, difficult to know for any certain season when that time will come. A reasonably favorable

time may be allowed to pass by the cattle feeder because he believes there will come a better time. Then, too, the majority feel that they must buy about a certain time in order to use economically available pasturage or roughage. The most common practice is to buy feeding cattle in the fall and early winter. It is believed that two-thirds of the feeding cattle are purchased during the fall and early winter months. This fact has come about naturally enough. Breeders of feeding cattle usually unload before winter sets in. If the season has been favorable, rendering pasturage abundant, and if winter does not set in until late, liberal arrivals of feeding cattle are likely to be late in reaching the feeding cattle markets. On the other hand, if a general drought or other unfavorable conditions prevail, it will cause a liberal marketing of cattle, which generally results in cheaper values for thin stock. Besides the cheapness of feeding cattle at seasons when cattle are plentiful, there is that other important advantage of being able to select more uniform feeders. There is, of course, the seeming necessity of purchasing feeding cattle in the fall or early winter if a large amount of roughage is to be used for the maintenance of cattle and the production of beef. Practically all those who do not buy their feeding cattle in the fall buy in the spring. The market at this season is usually higher, but where cheap roughage and good winter quarters are not available it is usually better practice to pay the extra prices in the spring than to attempt to winter such cattle under unfavorable conditions that are sure to render the practice unprofitable.

WHERE TO BUY

The answer to this question will depend largely upon the locality in which the cattle are to be fed and the extent to which the feeder is engaged in the business. Extensive cattle feeders, and by this we refer to those who

feed 100 or more cattle at a time, prefer the market or range as a source of supply. There are obvious reasons for doing so. As a rule, it is impossible to get together locally a large number of well-bred feeding cattle that are uniform in age, type and condition. Buying on the range or in the market frequently effects a saving of time. By taking advantage of a glut in the market or a lack of demand, the large cattle feeder is able to buy cheaper than he could in the country, as it is generally true that country prices do not fluctuate to the same extent as do market values. Good practice in beef production cannot, however, be established by assuming that abnormal conditions which will be favorable to the beef producer will always occur. Where local buying, either for the large or small feeder, is possible, it has distinct advantages, among which are a saving on freight, shrinkage, commission, and other expenses incident to buying; the breeding and normal condition of the cattle may be better determined, no bruising or gaunting incident to shipping, and finally, no acclimatization is necessary.

HOW TO BUY

It is assumed that the buyer in quest of feeding cattle knows what he wishes and approximately what he ought to pay for it. In case the source of his supply must come from the market it is wise to get in communication with some good live-stock commission company considerably in advance of the time the cattle are needed. Commission companies do not know, nor do they assume to know, everything. They do have opportunities of getting information on a wide range of subjects that are of utmost importance to cattle feeders. The permanency and success of their business depend upon the thoroughness with which they gather, interpret and dispense this information for the benefit of those whom they serve. They are not always able to tell from a feeder's description just what kind of

cattle he wishes to buy, hence a visit to the market by the feeder and a trip of inspection around the yards with the feeder buyer is advised in order to familiarize him with just the kind of cattle wanted. It is best, where possible, to aid in the selection of the cattle to be purchased, but when it comes to buying, the commission company can be of great help, because their daily contact with the work makes them quicker and more accurate in their judgment of values, weights and condition. They are frequently able to save many times their commission by being able to buy cheaper.

Good market reports with ably edited comments on the general crop and market conditions should be frequent visitors in every cattle feeder's home, and these should be carefully studied.

CHAPTER III.

THE VARIOUS GRADES OF FEEDING CATTLE DESCRIBED

The ability to select stockers and feeders intelligently is one of the first and most important lessons for the stockman to learn. Profits in steer feeding come not so much from skill in feeding and management as from intelligent buying and selling. The possibility of profit resulting from an increase during the fattening period of the value per pound of the initial weight of the animal is as great as is that resulting from the method employed in the feeding and managment. It is seldom possible to produce at a profit gains which do not increase the value per pound of the animal. Hence the importance of intelligent buying, or the selection of feeders and stockers of good quality.

FANCY SELECTED FEEDERS

Relatively, very few of this grade of stockers and feeders find their way to market. Breeders in any of the cattle feeding sections fortunate enough to own thinnish steers of such quality usually hold them until finished as prime bullocks, or sell them at home to feeders at good, strong prices, avoiding the expenses incident to shipping. Fancy selected feeders must not only possess the characteristics of choice feeders, but they must be uniform in color, give unmistakable evidence of being high grades of some one of the beef breeds, and they are almost invariably better fleshed than feeders of the good to choice grades. Fancy selected stockers and feeders are to the stocker and feeder class what prime steers are to the beef cattle class — the best grade within the class — and practically above adverse criticism.

CHOICE FEEDERS

Steers of this grade will, like those of the fancy selected grade, under proper management, develop into choice and prime steers. It would seem wise, therefore, to consider in detail their desirable characteristics.

It may be said, then, that we demand in choice

Fig. 1. Fancy Selected Feeder.

stockers and feeders, first, the ability to finish as choice or prime steers; and second, the ability to make economical gains in flesh and fat. As far as our present knowledge of the matter goes, we look for indications of these tendencies in the form, quality, and constitution.

1. *Form* — The general form should be low-set, deep, broad, and compact, rather than high up, gaunt, narrow and loosely made. Stockers and feeders should be low-set, or on short legs, because animals of this conformation are almost invariably good feeders and capable of early maturity. They should be deep, broad

and compact, because this conformation indicates good constitution, capacity for growth and for producing ultimately a relatively high percentage of the most valuable cuts. Select feeders with broad, flat backs and long, level rumps. They should possess straight top and underlines which should be nearly parallel; should be low at the flanks, thus forming what we have spoken of above as good depth, for the barrel of stockers and feeders as well as dairy cows should be roomy. An animal which is too paunchy, however, is objectionable to the butcher.

Secure as much smoothness of outline as is consistent with low flesh, being especially careful to avoid too great prominence in hips, tailhead, and shoulders. Avoid rough, coarse heads with small eyes set in the side of the head. Short, broad heads and short, thick necks indicate strong tendencies toward beef making. A large, prominent, and mild eye is to be desired. The mild eye denotes that the animal has a quiet disposition, which all feeders know is so desirable in a steer intended for the feed lot. The lower jaw should be heavily coated with muscle; the muzzle, lips, and mouth should be large but not coarse.

2. *Quality* — It is well to distinguish between what might be called (a) general quality and (b) handling quality.

(a) General quality. By general quality is meant general refinement of external conformation as seen in the head, horn, bone, compactness and smoothness of outline. General quality is affected by nothing so much as by breeding; in fact, the two are very closely associated. Good quality is seldom found in a plainly bred steer, but is generally characteristic of a well bred animal. The desirability of general quality cannot be too strongly emphasized. While it is a characteristic that involves many points and is difficult to describe, its presence or absence is quickly discerned by the trained eye of the intelligent buyer. It is this

characteristic in the stockers and feeders more than any other that we depend upon as indicating that the animal has within it the possibility of making a prime steer.

(b) Handling quality. Good handling quality indicates that the possessor is a good feeder. It shows that the animal is in good health or thrifty and capable

Fig. 2. Choice Feeder.

of beginning to gain as soon as an abundance of food is supplied. We speak of cattle as possessing good handling quality when the skin is mellow and loose. A thick, mossy coat of hair of medium fineness and a moderately thick skin are also desirable.

3. *Constitution* — The points indicative of good constitution have practically been covered under *Form*. Good constitution is indicated by a wide, deep chest, by fullness in the heart-girth, depth and breadth of body, and good handling quality. While we want refinement of form and bone, otherwise spoken of as general quality,

we do not want that refinement carried to the point of delicacy. Too much refinement means delicacy or a lack of constitution, and no animal lacking in constitution should find its way into the feed lot.

In the interest of uniformity in the finished product it should be observed that high-grade Herefords can usually be put on the market in the fewest number of days of full feed but suffer most from carrying beyond the point of ripeness; that Shorthorns and Aberdeen-Angus grades, while a little slower to mature, are in fully as strong demand in the market as are grade Herefords; and that Aberdeen-Angus and Galloways may be carried longer on full feed than other breeds of beef cattle without indications of bunches or rolls of fat, which are so strongly discriminated against in our markets.

After all that may be said, however, as to breed, the important consideration is to see that the steer should be a high grade of some one of the beef breeds and that the selection of the individual should receive more attention than the selection of the breed.

The question of age should not be overlooked. A thrifty young steer of good weight and in good flesh is to be preferred to an older, stunted steer. It should be said, however, that a stunted steer of any age or weight is a profit spoiler in the feed lot. Uniformity in color of feeders is desirable, but the mistake should not be made of getting uniformity in color at the expense of more important characteristics. It is possible to secure good colors, reds and blacks, in steers of very poor quality and containing very little beef blood. If it is a question of choosing between a combination of good quality and correct conformation, and good colors — take the quality and conformation, and let some other party have the colors. The writer has sometimes thought that it is a disadvantage rather than otherwise that most registered beef bulls are so prepotent in transmitting their color markings. A one-eighth blood Here-

ford may have Hereford markings, or a one-eighth blood Angus the color and polled characteristic of the pure Angus and have but little beef character.

Only those most familiar with market conditions realize what an almost insignificant proportion of well bred fat cattle reach our markets. The bulk of offerings are made up of common rough, medium, and good grades

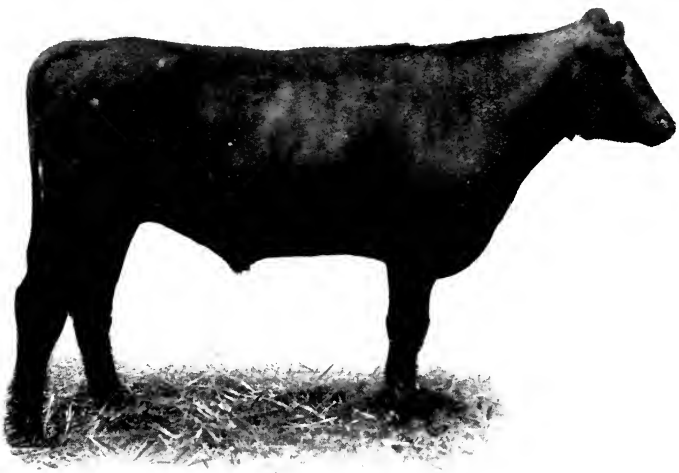


Fig. 3. Good Feeder.

of fat cattle, and these must necessarily come from low-grade feeding cattle, such as the inferior, common, medium, and good grades, assuming that the better grades of feeding cattle, the choice and fancy selected, previously described, finish into choice and prime steers.

GOOD FEEDERS

Good feeders possess only to a limited degree the beef, blood, the thrift, and the conformation of choice or selected feeders. It is not difficult to criticise them as

somewhat lacking in the most desirable characteristics of ideal feeders. They may be too long in the leg, too narrow on the back, and either too light or too heavy in the bone. Frequently feeders so graded have a tendency to be a little rough and coarse. It is generally true, however, that steers of this grade kept in the feed lot until ripe or finished will, in such condition, grade at

Fig. 4. Medium Feeder.

least as high as good beeves, while it is not at all impossible for them to become choice enough in condition to grade as choice bullocks.

MEDIUM FEEDERS

Medium feeders are only average as to quality and thrift. They are usually of lighter weight than the good, choice, and selected grades. They generally possess a fair amount of beef blood, enough so that their color is not objectionable. Their general appearance, so far as it indicates their quality and thrift, is rather against

them, indicating that no matter how judiciously they may be handled it will be the exceptional steer among them that will develop into anything better than a medium or possibly a good bullock. It is seldom good practice to finish this grade of feeders. (By finish we mean thick fat, such as is required in prime steers.)

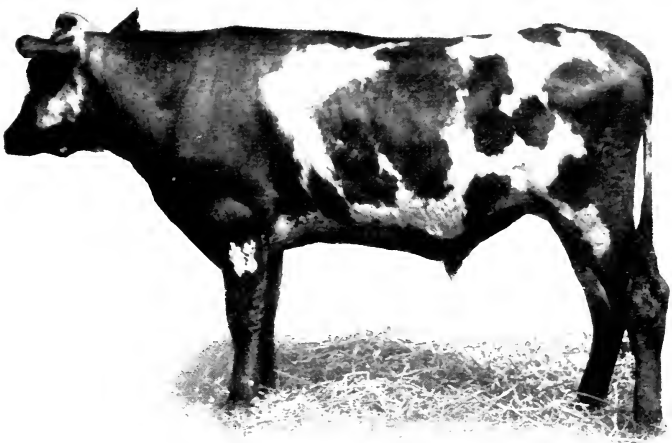


Fig. 5. Common Feeder.

COMMON FEEDERS

A common feeder is decidedly deficient in quality. When the word common is correctly applied to a grade of cattle the reader should at once know that that grade of cattle is noticeably deficient in quality; it usually also indicates a lack of desirable conformation and flesh. In speaking of feeders it indicates that such feeders are common in quality, common in conformation, and common in condition. Like medium feeders, it seldom pays to attempt to finish them.

INFERIOR FEEDERS

It would seem that a feeder of a lower grade than common might more properly be relegated to the level of a canner than be permitted the dignity of the name inferior feeder. As long, however, as there is sufficient demand for inferior feeders they cannot consistently be omitted from quotations of the live-stock market.

Fig. 6. Inferior Feeder.

Such feeders are rough and angular, largely devoid of natural flesh, and possessing the conformation of dairy rather than beef-bred animals. In the feed lot they are slow feeders and do not make satisfactory bullocks when fat.

Within all the grades of feeding cattle there are good feeders and indifferent ones, the proportion of good ones being largest in the better grades, while the proportion of indifferent ones is large among the lower grades. This suggests that in selecting feeding cattle, no matter of what grade, great care should be exercised in selecting only such as give evidence of good constitutions and feeding qualities.

CHAPTER IV.

INCIDENTAL EXPENSES IN THE CATTLE FEEDING BUSINESS

FREIGHT AND COMMISSIONS

In discussing the margins between buying and selling prices per hundredweight necessary to insure the cattle feeder against loss, freight, commission, and stockyards charges are important factors — indeed larger factors than they are ordinarily thought to be. The variability of freights to and from different sections of the country complicates considerably any attempt to make a treatment of the subject generally applicable. It is believed, however, by varying the freight rates and other variable items, an approximation of the importance of these factors in a given instance may be quite accurately determined. The following data have been arranged by Mr. L. D. Hall of the Animal Husbandry Department, University of Illinois.

In November, 1903, the Illinois Experiment Station bought on the Chicago market 130 choice feeding steers weighing 1006 pounds, at an average cost of $4.267 per hundredweight. The freight rate to Champaign (128 miles from Chicago) on stock cattle is 7.7 cents per hundredweight, being three fourths of the fat cattle rate. The shrinkage per steer, from market to feed lot, was 53.4 pounds. The steers were fed six months and gained 480 pounds, feed lot weights, at a cost of 7.23 cents per pound (not crediting pork produced) on a basis of 35 cent corn, $8.00 clover hay, and $24.00 linseed oil meal.

When shipped to Chicago in June they shrunk 22.5 pounds per steer, weighed when sold, 1410 pounds average, stood the experiment station at $5.79 per

hundredweight and sold for $6.10. In this case the margin between cost and selling price at market necessary to balance accounts was $1.52, or $1.01 margin between initial and final cost in the feed lot. In other words, about one-third of the cost per hundredweight of taking a feeder home, fattening, and returning him to market consists of freight, shrinkage, commission, and stockyards charges. These figures do not include hogs, labor, nor manure, which items are treated separately.

As stated, the average cost per hundredweight of the 130 steers was $4.267 in Chicago. The average cost at feed lots, just as they came from the cars, was $4.654, including freight, commission, feed, and shrinkage. It therefore cost $0.387 per hundredweight to get these cattle home. Of this expense, $0.257 per hundredweight was caused by shrinkage in weight, $0.0817 by freight (including $2.00 per car terminal charges), $0.0438 by commission and $0.004 by feed bills.

In order to determine the influence of freight rates in calculating the above balance accounts we may use a series of freight rates in calculating the above margins, using in each case a stocker rate equal to 75 per cent of the rate of fat cattle. In that way we find that the margins necessary to balance accounts are as follows:

Freight rates	Market margins	Feed lot margins
$0.10	$1.52	$1.01
0.15	1.60	1.00
0.20	1.68	.98
0.25	1.77	.97

These figures show that a difference of five cents in the freight rate on fat cattle involves a corresponding difference of about eight cents in the margin necessary to come out even.

It is assumed in the above calculations that the shrinkage in shipment to market is the same in each instance, viz., 22.5 pounds per steer. If the actual transaction described above be used as a basis, and various amounts of shrinkage assumed, we may de-

termine the effect of that factor on the margin necessary to pay out, thus:

Shrinkage, pounds	Margins
15.0	$1.49
22.5	1.52
25.0	1.53
50.0	1.64
75.0	1.75

This shows that 25 pounds shrinkage per steer corresponds very closely to eleven cents per hundredweight in margin required to break even. That is, every additional 25 pounds in average shrink means a loss of eleven cents per hundredweight on the cattle.

It is desirable in making estimates on a feeding operation to approximate these incidental expenses as closely as possible. The following figures are interesting as showing the weights on which freight is paid, compared with the weight of feeders when bought at market and their weight on arrival at the feed lots before filling. These are from records of feeding steers bought in Chicago by the Illinois Experiment Station.

Lot No.	Weight in pounds at market	Freight weight charged	Weight of feeders at feed lots
1	23,900	24,800	22,470
2	17,450	22,000	16,660
3	21,260	22,000	20,080
4	24,190	24,100	22,885
5	25,020	24,800	23,560
6	25,130	25,000	23,900

Where cars are loaded above the minimum weight, and of course they should be, the weight on which freight charges is based is ordinarily very near the weight of feeders as purchased. This is shown in the above table. In the case of fat steers shipped to market, the following figures show the weights of a representative carload shipped from the Illinois Station:

Weight fat steers at feed lot before shipment (yarded 12 hours)	25,750 pounds
Weight fat steers at market next day	25,280 pounds
Weight charged on freight bill	25,500 pounds

In the latter case we find that the freight charge was based on a weight about midway between the home and market weights.

It is important to remember that the expenses here discussed are a much larger factor in proportion to the investment in feeding lighter cattle than in heavy ones. Where the gain is put on at less cost than it sells for, the buying and marketing expenses are of greater importance and may equal or exceed the entire margin necessary to balance accounts.

At first thought it would seem that the higher the price paid for the feeders the less important would be the freight and stockyard charges in the operation, but such is not the case. For example, if in the above transaction the feeders had cost $3 instead of $4.267 the proportion of the margin required to come out even due to buying, shipping, and selling expenses would have been 27.6 per cent instead of 33 per cent; and if they had cost $5 per hundredweight, the proportion would have been 39 per cent.

LABOR AS A FACTOR IN CATTLE FEEDING

It has not been the custom in experiment station bulletins to make any definite statement as to the importance of the expense item of labor as compared with other necessary disbursements. A consideration of the subject of labor has usually been dispatched with some such statement as, "No charge is made for labor in caring for the steers or for bedding; neither is any value assigned to the manure made by them. It is believed that the agricultural value of the manure intelligently preserved and distributed would be sufficient to balance the cost of the bedding and labor involved." Labor, like many other factors in beef production, is variable.

The fact that it is a variable factor does not make a fairly accurate determination of it in any given instance impossible. If, however, we grant the fact that it is a variable factor it seems but reasonable to grant that the statement, that the fertilizer produced by the cattle balances the labor, is not, at best, a very accurate or exact one. The summer fattening of cattle on grass is economical of labor as compared with winter feeding in the dry lot. The self-feeder lessens labor, whether used in summer or winter. In feeding large numbers of cattle, labor can be economized to much better advantage than in feeding small numbers. Stall fattening or stable feeding as compared with open shed sheltering involves a large amount of labor. Again, the relative location of feed, water supply, and cattle and the conveniences for getting the feed to the cattle are all important factors.

In this discussion the writer has charged to the cost of the feed the expense of its preparation. That is, where corn is reduced to meal the expense of reducing the corn to meal is charged to the meal and not to the labor involved in feeding the cattle. Likewise chaffing hay, where practiced, may be, and is here, added to the price of the hay. In this way the labor involved in distributing the feed to the cattle is the item under consideration.

Experimental evidence relative to this subject is wanting; in fact, records of labor involved in the feeding of experimental cattle would be of little value, as the feeding of cattle in small lots and the recording of accurate weights of cattle and feed entail a large amount of labor that is in ordinary practice eliminated. For the purpose of securing a definite basis from which to work, we may assume what has been repeatedly accomplished in practice, that one man and team, or their equivalent, can care for and feed 200 cattle together with the hogs following. This includes not only feeding the grain, but also hauling hay or other roughage to the feed lot from nearby stacks or mows, providing

bedding, attending to water, and looking after the wants of steers affected with injuries, lump-jaw, lice, and itch. With this assumption as a basis the following statement is possible:

Man, 6 mo. at $40 (wages $25, board $15)	$240.00
Team and wagon, 6 mo. at $40 (maintenance $15, feed $25)	240.00
Total cost labor 6 mo	$480.00
Cost per steer	2.40

Suppose, again, that we are feeding two carloads of steers in such a way that a man and team can do the necessary work in two hours daily in connection with morning and evening chores. If we charge this time at 25 cents per hour, it amounts in six months to $90 for, say, 40 cattle, or $2.25 per head. If the arrangements are such that the same outlay for labor will accomplish the feeding of 60 steers, the cost per head will be $1.50, and if but 30 head require the same labor, then the cost will be $3 per steer. These figures enable us to name the approximate labor bill in common winter feeding as from $2 to $2.50 per steer, and it is understood of course that, other conditions being equal, the greatest efficiency of labor can be obtained in feeding large numbers of cattle. In comparing these statements with the returns from hogs, we may turn to the results of some feeding experiments. In one case where 53 pigs followed 130 steers in ten different lots, the return in pork at $5 per cwt. varied from 31.5 cents to $5.57 per steer, the average being $2.48. In another test, with pigs following meal fed steers, the conclusion was reached that, properly managed, the pig may return a credit of approximately $2.00 to each steer fed. The pigs in another experiment, involving 200 steers fed 94 days, made gains, which, calculated at $5 per cwt., amounted to $1.20 per steer, which may be considered the equivalent of twice that amount for a six-months' period. In still another test where 250 steers were used the pigs yielded a net

return of $3.12 per steer on the same basis as above. On the whole, then, it appears that the practice of considering the items of labor and pork about equal is generally not far wrong. It is also quite a general saying that the manure produced offsets the labor. We have shown in a previous chapter that from $9 to $18 per steer has been realized from the manure produced where the increase in crop yield is taken into account. The figures here presented indicate clearly that no general rule should be blindly followed. Such calculations as those above outlined are easily made for each proposition as it arises, so that guesswork may be almost eliminated and a very close approximation reached of what may reasonably be expected.

It is always a problem to what extent to move the cattle about in order to save moving feed, and, on the other hand, how far one may go profitably in moving feed to avoid moving the cattle. The best results, measured by gains and finish, require that the cattle be kept in their accustomed place and given every care regardless of labor. Moving cattle to a strange place is a certain handicap to them. The greatest economy of labor, on the other hand, is secured by taking the cattle to the feed rather than by carrying the feed to the cattle. Just where the line is to be drawn between these conflicting factors cannot be determined except in each case separately. Just here lies the great advantage of fattening on grass, especially where the self-feeder is used.

CHAPTER V.

SOME BUSINESS PHASES OF CATTLE FEEDING

RELATION OF COST OF FEEDS TO PROFITS IN CATTLE FEEDING

In attempting to estimate the probable number of cattle that will be fed during any given season and the probable profit or loss to the cattle feeder, there is no factor that is more frequently mentioned than that of the cost of feeds. From this we may assume that this factor, if not the most important one affecting profits in cattle feeding, is certainly one of great importance and one that should be thoroughly understood by every man engaged in the business of finishing cattle for the market. Live stock journals begin as early as July and August to anticipate the probable size of the corn crop, the probable demand for the same, and the bearing of these factors on the cost of corn to the cattle feeders of the country.

The cattle feeder is inclined to wait until he can form some intelligent opinion as to what the market value of corn will be before he decides to what extent he will engage in the cattle feeding enterprise. This is well, for, other things being equal, the cost of feeds determines the cost of gains and the cost of making gains has a very direct bearing upon profits and losses in cattle feeding.

A discussion of this subject upon the basis of feeding the steers a simple ration like broken ear corn and clover hay will be most helpful. At the Illinois Experiment Station the writer fed a carload of choice well-bred two-year-old Shorthorn feeding cattle from November to June, or in other words, during a six-months' winter feeding period on broken ear corn and clover hay.

These cattle weighed approximately 1000 pounds at the beginning and made an average daily gain per steer for the six months of slightly over two pounds. To be exact, the total gain per steer was 386.27 pounds. Just enough hogs followed the steers to consume the whole corn in the droppings of the steers to advantage. No additional feed of any kind was supplied for the hogs. In this way it was determined that 74.13 pounds gain on hogs was made per steer fed. It took 57.73 bushels of corn and approximately .8 of a ton of clover hay to secure the above gain on steer and pig. It is probable that the gains made per unit of feed were larger than those usually secured by corn-belt cattle feeders. Stated in terms of beef and pork per bushel of corn fed it would be 6.69 pounds beef and 1.29 pounds pork per bushel of corn fed. With these figures as a basis, we may assume that it would be fair for purposes of this discussion to consider that 6 pounds of beef and 1.14 pounds of pork (75 pounds per steer in six months) may be made from a bushel of broken ear corn supplemented with clover hay where the corn is fed to well-bred two-year-old feeding cattle with hogs following them to consume the waste. It should be stated that the cattle fed were not what would be called fully finished, as they sold in the market for $5.95, when the top of the market was $6.15 per hundredweight. Had these cattle been full fed for a longer time (they were full fed only about one hundred and twenty days) the total and average daily gains would probably have been larger.

The writer believes it would not have been difficult to have secured an average daily gain of 2.2 pounds per steer, or 396 pounds in one hundred and eighty days.

We have then sufficient data as to gains and feed required to produce gains to discuss intelligently the subject of relation of the cost of these feeds to profits in cattle feeding. To avoid misunderstanding let us repeat that we assume that each steer involved in this

discussion makes an average daily gain of 2.2 pounds, or 396 pounds for a six-months' winter feeding period, that 75 pounds of pork are made from the droppings of the steer, that 6 pounds of beef and 1.14 pounds of pork are made from each bushel of corn fed, supplemented with clover hay. On this basis it would require about 66 bushels of corn, supplemented with one ton of clover hay to secure the gains recorded for the whole time.

Granting that we are dealing with a choice 1000-lb. feeder that is worth $4.50 per hundredweight in the feed lot, the following financial statement might be made up:

DISBURSEMENTS, EXHIBIT A

One 1000-lb. choice feeder at $4.50 per cwt.	$45.00
66 bushels corn at 30c. per bushel	19.80
One ton clover hay at $5	5.00
Total cost	$69.80

The above "total cost" does not, of course include interest on investment or labor, and to simplify the discussion it is assumed that the cattle are sold at home, thus doing away with marketing expenses.

For the first statement 30-cent corn and $5 hay is taken as about the minimum prices that could be figured even from the viewpoint of the cattle feeder who produced his feeds. If the choice, well-bred feeding steer cost $4.50 per hundredweight in the feed lot and the purchaser gets what he pays for and properly finishes the steer, he ought to expect $1.25 per hundredweight more for the steer at home in the feed lot than cost price delivered in the feed lot.

RECEIPTS, EXHIBIT A

One 1396-lb. choice to prime steer at $5.75 per cwt.	$80.27
75 pounds pork at $5 per cwt	3.75
Total receipts	$84.02
Total expenditures	69.80
Profit per steer on basis of 30c. corn and $5 hay	$14.22

The following table, figured out in the same manner, shows the effect of price of feeds on possible profits:

EXHIBIT B

Assumed price of corn per bu.	Assumed price of hay per ton	Disbursements	Receipts	Profit per steer	Net cost lb. gain — pork credited
$0.30	$5.00	$69.00	$84.02	$14.22	$0.053
.35	7.50	75.60	84.02	8.42	.068
.40	10.00	81.40	84.02	2.62	.082
.50	10.00	88.00	84.02	—3.98*	.099
.60	10.00	94.60	84.02	—10.58*	.116

* These figures represent losses.

This table does not mean that profits in cattle feeding are impossible when corn is worth over 40 cents per bushel, with clover hay at $10 per ton. It does mean, however, that with the conditions stated that a larger at-home margin between buying and selling price than $1.25 per hundredweight is required to make the enterprise profitable.

RELATION OF INITIAL WEIGHTS OF FEEDING CATTLE TO PROFITS ON FINISHED BEEF

The initial weight of feeding cattle has a direct bearing upon possible profits in cattle feeding. In practice it is difficult to secure examples where differences in initial weight of feeding cattle selected for the feed lot are the only differences. In other words, it is not likely that a 750-lb. feeding steer will be of the same age, thrift, condition, quality, and price as a 1050-lb. steer. In most instances, differences other than differences in initial weight would also have a direct bearing upon the feeding qualities and possibilities of feeding cattle. In order, however, to make clear the principle involved in variations in initial weight of feeding cattle it will be necessary to assume that we are dealing with this factor only. Perhaps the best way to consider this

question is to compare two financial statements, one on the basis of starting with the 800-lb. feeder, and the other a 1000-lb. feeding steer. Assuming that the total gains and cost of gains would be the same in either case, the statement would be something as follows:

One 800-lb. choice feeding steer at $4.50 per cwt	$36.00
66 bushels corn at $0.40 per bushel	26.40
One ton clover hay at $7.50 per ton	7.50
Total disbursements	$69.90
Credit 75 pounds pork at $5 per cwt	3.75
Net cost of steer at time of marketing	$66.15

Granting that the 800-lb. feeder would gain 405 pounds in a six-months' feeding period, during which time each steer received 66 bushels of corn and one ton of hay, the steer, when finished and ready for the market, would weigh 1205 pounds. According to the statement of expenditures made above, this 1205-lb. steer would have cost at time of marketing $66.15, and in order that the cattle feeder should come out even, that is, neither make nor lose by the enterprise, the steer would have to net approximately $5.49 per cwt. in the feed lots at home. Since it was assumed that the steer cost $4.50 per hundredweight this would mean a $.99 margin between buying and selling price. For sake of comparison, let us now assume that we buy a 1000-lb. feeding steer, of the same quality, for finishing:

One 1000-lb choice feeding steer at $4.50 per cwt	$45.00
66 bushels corn at $.40 per bushel	26.40
One ton clover hay at $7.50 per ton	7.50
Total disbursements	$78.90
Credit 75 pounds pork at $5 per cwt	3.75
Net cost of steer at time of marketing	$75.15

Starting with a 1000-lb. steer that gains 405 pounds in six months, a 1405-lb. steer is produced, which to

meet above disbursements, would have to sell for about $5.34, or 84 cents per hundredweight above cost. Putting it in another way, it might be said that other things being equal a 1000-lb. feeding steer can be finished on a 15-cent smaller margin than a steer weighing but 800 pounds at the start. The reader should bear in mind that in making these financial statements the writer has adopted for demonstrating this and other phases of the cattle-finishing business one of the simplest methods of feeding calculated to produce cheap gains, and where cheap gains prevail as has been shown, the necessary margin between buying and selling price is reduced to the minimum. The labor involved and interest on investment is not charged, nor is any credit given for fertilizer produced.

Perhaps the importance of this factor would be more quickly seen if the first-named example were taken, viz., a comparison of the 800 and 1000-lb. feeding steers. Suppose when the cattle are marketed a $1.50 per hundredweight margin over cost price is secured in each instance, then the total value of the (800 plus 405 equals 1205-lb.) steer would be $72.30. The net cost of this steer, including feed, less value of pork product, was $66.15. This would leave a profit per steer of $6.15. In case of the 1000 plus 405 equals 1405-lb. steer, the value at marketing time would be $84.30. The net cost was $75.15, leaving a profit per steer of $9.15; this item alone then showing a difference in profit of $3 per steer.

The following table shows the effect of differences in initial weight of feeding cattle from 700 to 1200 pounds:

Initial Weight of Feeding Cattle	700 lbs.	800 lbs.	900 lbs.	1000 lbs.	1100 lbs.	1200 lbs.
Initial cost of steer at $4.50 per cwt	$31.50	$36.00	$40.50	$45 00	$49.50	$54.00
Net cost of feed (total cost less $3.75 for pork)	30.15	30.15	30.15	30.15	30.15	30.15
Final cost of fat steer per cwt	5.60	5.49	5.41	5.35	5.29	5.25
Margin required between buying and selling price, home or feed-lot values and weights	1.079	.989	.914	.849	.792	.746
Difference in cents in margin necessary between each weight	0.00	8.95	7.58	6.51	5.64	4.62
Total difference in cents between 700 lb. and each larger weight	0.00	8.95	16.53	23.04	28.68	33.30

COST PRICE OF VARIOUS GRADES OF FEEDING CATTLE IN RELATION TO PROFITS

In determining what quality of cattle will be most profitable to feed, there is one consideration not generally understood. A brief statement of the principle involved is likely to be questioned. The principle referred to is as follows: The lower the price at which feeding cattle are purchased, whether because of prevailing low prices for feeders, or because of the low grade of the cattle, the larger must be the margin between the buying and selling price in order to secure protection against loss. As suggested, this principle applies not only to the purchase of feeders of various market grades at prices differing materially, but to the purchase of feeders of the same grade at different prices.

The following table shows to what extent this principle operates:

Market Grades of Feeders	Fancy selected	Choice	Good	Medium	Common	Inferior
Assumed cost per cwt in feed lots	$4.50	$4.15	$3.80	$3.45	$3.10	$2.75
Total cost of 1000-lb. feeder at above prices	45.00	41.50	38.00	34.50	31.00	27.50
Net cost of feed, or cost of feeds for finishing, less value of pork produced	30.15	30.15	30.15	30.15	30.15	30.15
Total net cost of steer at marketing	75.15	71.65	68.15	64.65	61.15	57.65
Weight of steer at time of marketing, lbs.	1405	1405	1405	1405	1405	1405
What steer must sell for per cwt. at home to insure cattle feeder against loss	$5.35	$5.10	$4.85	$4.60	$4.35	$4.10
Necessary margin above cost price to insure against loss	.85	.95	1.05	1.15	1.25	1.35

It is obvious that the writer could not determine a set of values that would obtain in all markets and in all seasons. The assumed values are sufficiently close to average feed lot conditions to render them valuable for illustrating an important principle. It is assumed that the steers of the various grades make the same gains in a given time on a given amount of feed. As a matter of fact, the better grades will eat more and gain more rapidly than the commoner grades. However, if there was only the one varying factor and that the cost per hundredweight of the feeders the principle enunciated would hold.

That there should be a difference in margin required between buying and selling price to come out even of 50 cents per hundredweight in this instance and approximately 30 cents per hundredweight where all varying factors are taken into consideration would scarcely be realized by the casual observer.

The reader is cautioned, however, not to misinterpret the principle. It clearly shows that a greater margin is necessary with the cheaper cattle. The

writer does not presume to discuss at this time as to whether or not margins sufficiently large to balance or more than balance the requirement are likely to follow the finishing of low-grade steers to render their fattening a more profitable enterprise than the feeding of the better grades. In general, however, the extreme differences between the various grades of feeding cattle tend to become less marked as the feeding process goes on. That is to say, the differences in quality between the various grades of feeding cattle are more pronounced than differences between the various grades of beef or fat cattle.

Buying feeding cattle is almost the first, if not the first, step to be taken in cattle feeding. The amateur cattle feeder seldom appreciates the importance of this factor in determining ultimate profits. The veteran feeder has learned by costly experience that unless he buys his feeding cattle right, that is, unless he gets good value for his money, all possible hope for profit has been destroyed before the real work of finishing begins. If the beginner appreciates the importance of right buying he seldom possesses adequate knowledge of the relative and absolute values of the various grades of feeding cattle.

CHAPTER VI.

WINTERING STOCKERS AND FEEDERS

The writer is unable to present any statistics indicating the percentage of cattle purchased for feeding purposes that are simply "wintered" principally upon roughage with a view of finishing subsequently on grass. It is generally known, however, that a large majority of the cattle purchased for fattening are purchased in the fall and early winter months, and more than half of these are bought with a view of wintering them as cheaply as possible and then fattening on grass. The reasons for this system of management are not far to seek.

On the average corn-belt farm there are stalk fields and straw stacks from which little if any revenue is secured unless used in wintering cattle. In other sections straw, clover-hay and other roughages do not find a ready cash market, and because of this some other disposition is made of them. Wintering cattle for subsequent fattening on grass seems to be the most popular channel through which to convert these feeds into cash. Summer fattening is usually more profitable than winter fattening and is much more generally practiced. Those in possession of good pasturage wish to make the best use of it and consequently do not feed liberally of corn or other concentrates during the winter months. In this connection it may be stated that, as a general proposition, the more cattle gain on concentrated feeds in winter the less they will gain on grass in the summer. That is to say, if corn is fed liberally during the winter months, the cattle will not make as large gains when turned to grass as they would were they wintered largely on roughage and not the best of roughage at that. Dif-

ferent systems of management should undoubtedly be recommended for cattle varying in age and quality. The wintering of calves and yearlings intended for baby beef will be considered in a subsequent chapter. This narrows the subject in hand to the wintering of yearlings, two-year-olds, and older feeding cattle that are to be finished on grass in summer.

ROUGHING STEERS AN ART

Experienced cattle feeders will concede that it is one of the fine points of the cattle feeding business to know just how well to winter such cattle. Local conditions as to the extent, nature, and value of pasture lands determine to a large extent what is good practice in any particular instance. Where abundant pasturage of the best quality is available on cheap lands, feeding cattle may very properly be wintered largely on roughage without any effort on the part of the cattle feeder to secure large gains. But if pasturage is limited and the value of such pasture lands is great, then some combination of feeds well calculated to produce satisfactory gains should be used.

The writer believes that there is a growing tendency over a large part of the corn-belt, where these conditions prevail, to feed cattle more liberally than formerly and that this tendency is in harmony with good practice. It is rarely economy to carry stockers or feeders a considerable time on a mere maintenance allowance, even though the subsequent gain on grass be thereby increased.

As bearing on this general subject of wintering feeding cattle some interesting records of the Missouri station are quoted. The results in feeding all the roughage of various kinds that yearling steers would eat with corn in varying quantities produced the following results in three successive years:

Kinds of Roughage	Date of Trial	Pounds hay per steer daily	Pounds shelled corn per steer daily	Av. daily gain per steer in pounds
Timothy	1899-1900	16.7	4	.65
Timothy	1901	15.4	6	1.00
Timothy	1901-2	16.9	6	1.37
Clover	1901	17.9	6	2.00
Clover	1901-2	19.0	6	1.92
Cow-pea	1899-1900	19.0	4	1.54
Millet	1901	12.3	6	.37
Alfalfa	1901-2	16.9	6	1.63

These records graphically show the value of clover, alfalfa, and cow-pea hay as compared with other roughages when used as a supplement to corn for wintering cattle. It would seem from the experiments quoted that from 4 to 6 pounds of shelled corn per steer per day fed in conjunction with all the good clover, alfalfa, or cow-pea hay the steers will eat makes an ideal feed for wintering feeding cattle and that the use of timothy and millet hay will be followed by unsatisfactory results. The writer does not forget that the larger winter gains will undoubtedly make the gains on grass in summer somewhat less, but it should be remembered that these gains were made on a ration a large percentage of which was roughage. These records are valuable as further indicating the amounts of the various roughages such cattle will consume when fed all they will take.

CHAPTER VII.

GETTING CATTLE ON FEED

It not infrequently happens that steers intended for the feed lot are left to roam about the stalk fields longer than it is profitable to do so. Feeding cattle should be taken from stalk fields and pastures before they cease thriving under such management. How the steers should be handled subsequently will depend largely upon the age, grade, and condition of the steers, when they are to be marketed, and the most available feeds.

The majority of cattle coming from pastures a d stalk fields will not be finished for market in less than 150 days, while many of them will be carried through the winter on rough feed as cheaply as possible and turned to grass in the spring at a time when they are practically on full feed.

The cattle which are to be marketed after being turned to grass in the spring should be handled differently from those that are to be sold earlier. (See chapter XV., Fattening Cattle on Grass.)

PLANS VARY SOMEWHAT

Those who are familiar with cattle feeding practice know that there is much difference of opinion as to the length of time which should be employed in getting cattle on full feed. The majority of cattle feeders, I believe, practice a system of feeding which involves the getting of the cattle on full feed in from ten days as the minimum to thirty days as the maximum length of time. The minority take what appears to be a more rational view of this question and use from thirty days at the least to sixty days at most for getting cattle on feed. Both methods have their advantages and disadvan-

tages, which at present must be stated more as opinion than as a result of deductions from actual experiments covering a comparison of these methods, although at the Illinois Station both these systems have been tested, and there is an experiment now in progress at the station referred to inquiring into this very question. First, it should be said that both methods are followed with varying success. Cattle may be put on full feed in from fifteen to thirty days without apparent injury. The advantage of this method is a saving of time or a shortening of the feeding period. It contributes to larger gains during the first part of the feeding period, and, taking the whole feeding period together, it is believed to induce a larger consumption of concentrates and a consequent smaller proportion of roughages. With this system of feeding the gains grow smaller and more expensive during the latter part of the feeding period, provided the same extends five months or more of full feeding and provided aged rather than young cattle are involved.

AS TO SHORT-FED CATTLE

In dealing with short-fed cattle, getting cattle on full feed in fifteen to twenty days is undoubtedly advisable, but if cattle are to be in the feed lot six months they can be given a very satisfactory marketable finish where thirty to forty-five days of that time are employed in getting them on full feed. The advantages of this method are: The ration is at first made up of such bulk as to permit the steers eating all they wish without any danger of getting the cattle off feed or deranging the digestive organs. The grain ration is so gradually increased that the steers become accustomed to handling a heavier and more highly concentrated ration. This method is safer in the hands of the novice. Gains are not so large during the first part of the feeding period as they are where cattle are put on feed more rapidly, but they are still economical as viewed from the standpoint of feed consumed to produce this gain. As the feed is

increased slowly and regularly the gains increase with the extent and concentration of the ration until the gains during the last sixty days of a six-months' feeding period are just as large and frequently as economical as at other periods during the fattening process. Steers so handled can be more safely carried beyond the time planned to market them in case occasion seems to warrant such holding than they can where started more quickly.

THE AIM OF THE FEEDER

Where thirty days to six weeks are employed in getting cattle on full feed the cattle so handled very seldom consume the large amounts of corn and other concentrates reported by cattle feeders who practice getting cattle on feed more rapidly. The gains made per unit of feed consumed are no less than with the quick feed method even though a larger proportion of the ration consists of roughage. The end and aim of the cattle finishing process is, I take it, to get marketable finish at the least cost, considering cost of feeds used and interest on investment. Economical gains contribute very largely in bringing about this result and are, in fact, a more important factor than a little extra time, which may be required by getting cattle on feed in a more rational manner. With good alfalfa or clover hay used as roughage it is undoubtedly better practice to get cattle on full feed more slowly than where corn stover, timothy hay, or straw constitute the roughage.

VALUE OF SUPPLEMENTAL FEEDS

If for any reason it is desirable to get cattle on feed quickly, the supplementing of corn with some nitrogenous concentrate, like ground linseed cake (oil meal), gluten, or cottonseed meal is recommended. Granting that not less than thirty days are to be used in getting cattle on full feed, the writer would feed the cattle all the clover or alfalfa hay they would eat up without waste and in addition start with two pounds of corn per

steer per day, increasing the corn at the rate of one pound per steer per day until each steer receives ten pounds of corn per day. This ration of corn should be continued for three days and then another increase of one pound made. From this point on an increase of one pound per steer per day every third day will bring the cattle up to seventeen pounds of corn each per day in thirty days. By continuing this rate of increase for fifteen days longer the steers will be getting twenty-two pounds each per day. If oil meal or other nitrogenous concentrates are used at the rate of about three pounds per 1000-lb. steer per day, this ration will prove quite satisfactory. When the cattle begin to get about twelve to fifteen pounds of corn per steer per day they will not require or relish as much roughage, and at the end of thirty days should not be given to exceed twelve pounds clover or alfalfa per 1000-lb. steer per day. As the feeding period progresses the amount of roughage fed should constitute about one-fourth of the ration by weight.

CHAPTER VIII.

FEEDS FOR FATTENING CATTLE; THEIR PREPARATION AND USE

CORN

That corn is and will be fed more largely than any other feed is admitted, hence the knowledge of how it can be used most profitably is information that every cattle feeder should possess. Corn is fed in many forms, such as fodder or shock corn, cornmeal and corn and cob meal, and the feeding of corn in each of these forms is advocated as the most profitable practice by a considerable number of cattle feeders. In some instances good and sufficient reasons are given for their choice, while in other instances statements are made which are not borne out by experimental data on the subject. It is undoubtedly true that corn is not fed most profitably in any one particular form under all circumstances and conditions.

A study of this subject involves the following considerations:

1. The efficiency of corn for making beef alone when fed in different forms.
2. Its efficiency for making beef and pork.
3. The labor involved in preparing and feeding it to cattle.
4. The age of the cattle to be fed.
5. The season of the year.

Unfortunately, experimental evidence is lacking on some of these points. However, we wish to introduce at this point some experimental data gathered by the Illinois Experiment Station in feeding 130 choice two-year-old feeding cattle during a six-months' winter feeding period, leaving other points of interest to sub-

sequent pages. In the experiment referred to corn in its various forms was supplemented with oil meal or gluten meal and clover hay. So, in interpreting the records of this test, it should be borne in mind that with each bushel of corn the concentrates and clover hay mentioned were fed.

POUNDS GAIN ON STEERS AND STEERS AND HOGS PER BUSHEL (SHELLED BASIS) SUPPLEMENTED CORN FED

Form in which corn was fed	Pounds oil and gluten meal fed per bu. corn	Pounds clover hay fed per bu. corn	Pounds of gain on steers per bu. corn fed	Pounds of gain on steers and hogs per bu. corn fed
Silage, cornmeal.	10.121	24.681†	7.93	8.04
Ear corn	9.996	27.241	7.92	9.06
Cornmeal	9.878	29.698	8.02	8.39
Corn and cob meal	9.979	27.613	7.88	8.21
Shock corn, ear corn	4.549*	22.547†	6.41	7.72
Shelled corn	10.120	30.502	6.72	8.74

*Oil meal fed during the latter part of feeding period only.
† The roughage accompanying the corn was fed in these lots in addition to the clover hay.

From the accompanying table it will be seen that from the standpoint of beef produced per bushel of corn fed in the various forms, silage and cornmeal were most efficient.

The results of this experiment indicate that the mere matter of grinding shelled or ear corn does not make it materially more efficient than broken ear corn for beef production, but either cornmeal, corn and cob meal, or broken ear corn were considerably more efficient than shelled corn for beef production. That ear corn should be found more efficient for beef production than cornmeal or corn and cob meal is contrary to common belief, but this experiment was conducted on such a large

scale and in such a careful manner that the results of it are more dependable than opinions or beliefs. The great importance of the data in the last column of the table should not be lost sight of. In sections of the country where beef production is a leading enterprise the hog is looked upon as an economic factor and therefore practically indispensable. The amount of gain that is made by hogs following steers variously fed is therefore one of the deciding factors as to the form in which corn may be most profitably fed to cattle. By referring to the table it will be noted that the most beef and pork combined was made where corn was fed in the form of broken ear corn, shelled corn coming next, with cornmeal third. The slight difference between the final results with cornmeal and corn and cob meal leads the writer to believe that they are practically equal in feeding value — that is to say, when cattle are handled as these were with plenty of good roughage and the corn supplemented with some nitrogenous concentrate, a bushel of ear corn (70 pounds), fourteen pounds of which is cob, when ground into corn and cob meal is not materially more valuable for cattle feeding than fifty-six pounds of cornmeal.

The experienced cattle feeder knows that simply the statement that one ration will produce more beef or more combined beef and pork than another does not necessarily decide that its use will be followed with greater profit. The question of cost of preparing and feeding the same must be taken into account. This will be considered next.

PREPARATION OF FEED

In the experiment referred to the feeds used were prepared at the University cattle feeding plant. Both the corn and the corn and cob meal were finely ground. The shock (fodder) corn and silage used were grown in the same field on the University farm, and the plots reserved for use were selected with the greatest care, that

the quality and proportion of grain to stover should be the same in each instance. Of the total crop 56.6 per cent was grain and 43.4 per cent stover.

Taking into account depreciation in machinery by wear and the actual labor involved, the records show that it cost the following amounts to prepare the feeds used:

	Per ton.
Shelling corn	$ .34
Grinding corn for cornmeal	1.20
Grinding ear corn for corn and cob meal	1.44
With corn at 35c. per bushel—	
Broken ear corn cost	$10 20
Shelled corn	12.48
Cornmeal	13.34
Corn and cob meal	11.44
Shock corn, including cost of hauling to feed lots	5.40
Silage, including cost of putting up	2.75

Good average daily gains were made with corn fed in all the various forms, although shelled corn and shock corn did not equal other forms. The average daily gain per steer for the six-months' feeding period was as follows: Silage and cornmeal, 2.34 pounds; broken ear corn, 2.33 pounds; cornmeal, 2.38 pounds; corn and cob meal, 2.32 pounds; shock corn, 2.08 pounds; and for shelled corn, 1.99 pounds.

The lots fed corn in various forms were fed for the same length of time and marketed in Chicago on the same day, at which time they were sold at the following prices per cwt.: Silage and cornmeal lot, $6.10; broken ear corn, $6.15; cornmeal, $6.15; corn and cob meal, $6.10; shock corn, $6.05; and the shelled corn lot for $6.05. The feeding cattle at the beginning of the test cost $4.53 per cwt. in the feed lots and graded as choice.

To illustrate what an important item the labor element is in the preparation of cattle feeds it may be stated that the net cost of a pound of gain on the steers was in each instance as follows: Silage and cornmeal

lot, $0.076; broken ear corn $0.067; cornmeal, $0.075; corn and cob meal, $0.078; shock or fodder corn, $0.065; and in the shelled corn lot, $0.075. Thus it will be seen that the cost of a pound of gain is directly influenced by the amount of labor that is expended in the preparation of the corn for feeding. The net profit per steer in feeding these cattle corn in its various forms and at varying prices follows:

Price of Feeds			
Corn	$.35	$ .40	$.50
Clover hay	$5.00	$7.50	$10.00
Form in which corn was fed	Net profit per steer		
Silage and cornmeal	$6.57	$2.17	—*$4.840
Broken ear corn	12.07	7.54	.330
Cornmeal	8.45	3.66	—3.750
Corn and cob meal	6.61	2.07	—5.150
Shock or fodder corn	11.46	7.01	.125
Shelled corn	7.95	3.14	—1.270

*— Indicates a loss.

The results of this experiment clearly indicate that simple methods, or, in other words, cattle feeding practice involving but a small amount of labor requires considerably smaller margins than do more complicated methods involving a large labor element.

The results of this experiment are so striking that it appears that the grinding of corn for feeding choice two-year-old steers during the winter season is not warranted.

The feeding of silage in moderate quantities is not necessarily conducive to heavy shrinkage in shipping or small percentages of dressed beef. The reader is cautioned not to conclude that since the feeding of silage was not followed with as large profits as the feeding of several other rations, that it has no place in beef pro-

duction. Its use in growing young cattle and as a part of the ration of the breeding herd promises well in the hands of the experienced feeder.

Since the profits in feeding shock or fodder corn and ear corn are approximately the same, the writer is inclined to favor the feeding of ear corn in preference to fodder corn, because in feeding shock corn one is sometimes obliged to get on the land when it is too wet. This statement applies especially to seasons of the year when bad weather is likely to prevail.

This suggests that there may be a season of the year when shock corn can be fed to greater advantage than during mid and late winter. It is doubtful whether there is a more profitable way to feed corn than in the form of shock or fodder corn, if it is fed during the fall season.

While the results of this experiment show that it does not pay to grind corn for winter feeding, it should not be assumed that it does not pay to grind corn for cattle that are being fattened in the summer on grass. In some instances, too, young cattle are not able to handle the ear corn to advantage. Some of the modern improved varieties of corn are so compact and hard that cattle have difficulty in masticating it. Whether or not the cattle feeder should use cornmeal or corn and cob meal is largely a matter of convenience, what roughage is used, how the corn part of the ration is supplemented with other concentrates, and perhaps the season during which it is used.

Unless higher prices for fat cattle, or lower prices for stock cattle, or both, prevail than in conditions here recorded, the possibilities of profit with corn at 40 cents per bushel, for example, and clover hay at $10.00 per ton are very small indeed.

THE USE OF COTTONSEED MEAL, GROUND LINSEED CAKE OR OIL MEAL, OATS, AND MOLASSES

It has been demonstrated to the satisfaction of the writer that in fattening cattle where corn comprises the bulk of the ration it pays to supplement it with

some nitrogenous feed either concentrate or roughage. Cottonseed meal, ground linseed cake or oil meal, and gluten meal are among the most common nitrogenous concentrates, while alfalfa, clover, and cow-pea hay are nitrogenous roughages. Whether or not it will pay to buy nitrogenous concentrates where good clover or alfalfa hay is available depends upon the age of the cattle to be fed, the price of corn, and the price of cotton seed meal, oil meal, or some other available nitrogenous concentrate.

AN ILLINOIS FEEDING EXPERIMENT

During the winter season of 1903–1904 the Illinois Experiment Station fed one carload of two-year-old choice feeding cattle on broken ear corn and clover hay and another carload of cattle of the same age and grade on broken ear corn, clover hay, gluten meal, and oil meal (pea size ground linseed cake). These cattle were fed for a six-months' feeding period and were well finished at time of sale. Feeds were charged at the following prices:

	Per ton.
Ear corn, 35c. per bushel, broken ear corn	$10.20
Oil meal (ground linseed cake, pea size)	24.00
Gluten meal	29.00
Clover hay	8.00

With a ration of broken ear corn and clover hay results were as follows:

Average daily gain per steer in pounds (186 days)	2.08
Pounds pork per steer made by hogs following	62.60
Pounds gain on steers per bushel corn fed	6.69
Pounds gain on steers and pigs per bushel corn fed	*7.98
Net cost of 1 pound gain on steers	$.059
Cost per cwt. of feeders in feed lot	$4.53
Value per cwt. when marketed	$5.95
Net profit per steer, corn 35c., clover hay $8 per ton. Gains in pork credited at $5 per cwt.	9.84
Net profit per steer, corn 40c., clover hay $10	5.68

*With each bushel of corn fed in this lot there was an average of approximately ten pounds of oil meal or gluten meal fed in addition to the corn, which of course was not the case where corn was not supplemented with a nitrogenous concentrate.

With broken ear corn, gluten meal, oil meal and clover hay:

Average daily gain per steer in pounds (186 days)	2.33
Pounds pork per steer made by hogs following	74.13
Pounds gain on steers per bushel corn fed	7.92
Pounds gain on steers and pigs per bushel corn fed	9.06
Net cost of 1 pound gain on steers	$.067
Cost per cwt. of feeders in feed lot	$4.53
Value per cwt. when marketed	$6.15
Net profit per steer, corn 35c., clover hay $8 per ton, Gains in pork credited at $5 per cwt	9.75
Net profit per steer, corn 40c., clover hay $10.00	5.36

By referring to the table it will be seen that the steers getting the oil meal and gluten meal made larger daily gains throughout the feeding period than did those that received only broken ear corn and clover hay. This result usually follows such practice because the supplementing of corn with a palatable nitrogenous concentrate undoubtedly stimulates the appetite and increases the capacity of the animal for consuming to advantage large quantities of concentrates. This system of feeding is to be recommended, therefore, where the securing of a quick finish is of more consequence than the somewhat increased cost of the gains.

GAINS MADE BY HOGS

It has frequently been stated that better gains are secured on hogs following steers fed on corn supplemented with oil meal than where it is not so supplemented. It is possible that in the above statement reference was made to the cattle not fed a nitrogenous roughage such as clover hay. This test at any rate points to the conclusion that where corn is supplemented with both a nitrogenous concentrate and a nitrogenous roughage the hogs make smaller gains than where supplemented with clover hay only. This is as it should be, for if it is true, as is pretty clearly shown by a comparison of the pounds of beef made per bushel of corn fed, that the supplementing of corn with the concentrated feeds used

in this test increases the efficiency of corn for making beef, there must of necessity be less of the corn in the droppings of the steers for producing gains on the pigs. It is not probable that the pigs get much benefit from the undigested portion of these concentrated feeds, especially where whole corn is fed.

A comparison of the cost of gains will bring out forcibly the point that the most efficient rations are not necessarily the most economical producers of gains. Notwithstanding the fact that the cattle receiving the oil meal and gluten meal were enough better finished to sell in the open market for 20 cents per hundredweight more than the ones getting corn as the only concentrate, a comparison of the relative profit indicates that with feeds at the prices named it matters but little so far as visible profits are concerned whether or not the cattle feeder uses these nitrogenous feeds for two-year-old cattle for winter feeding. In the financial statements given no charge has been made for interest on investment in cattle, hogs, and equipment, or for labor required, nor are the cattle and hogs credited with any fertilizer produced. It should not be overlooked, however, that while in actual visible returns one ration appears about as good as another, as a matter of fact the manure from the oil meal or gluten meal fed steers would be considerably more valuable than that from the steers fed corn only. The cost of gains looks low, and it is low only because corn is charged at the rate of 35 cents per bushel.

The question of the use of these supplementary feeds where clover, alfalfa, or cow-pea hay is not available will be considered next.

NITROGENOUS CONCENTRATES

It frequently happens that the cattle feeder does not have alfalfa or clover hay to use as roughage in fattening cattle and must depend upon timothy hay, corn stover, or straw. In such instances it becomes a

pertinent question whether or not it will pay to purchase nitrogenous concentrated feeds such as oil meal, cotton-seed meal, or gluten meal to add to the ration in order to partially or wholly balance it. In presenting the results of the following test the writer believes that conclusive evidence is available that it does pay. This test was conducted at the Illinois Experiment Station during the winter of 1902–1903. During this time prices for feeds and cattle were extremely high, and in order to make this test illustrate the principle involved in this discussion the prices of cattle and feeds are reduced to as nearly a normal basis as it is possible to make them. The cattle used were grade Shorthorns, but of a rather low grade. On the market they graded from medium to good feeders, weighing about 970 pounds each. Ordinarily such feeders can be secured in the fall of the year for $3.80 per hundredweight delivered in the feed lots. The cattle used in this test were here figured at this price. Feeds used were charged at the following prices:

Shelled corn, 35 cents per bushel; gluten meal, $29.00 per ton; timothy hay, $10.00 per ton; and corn stover at $4.00 per ton. There were twelve steers in each lot, one of which was fed a ration of shelled corn, timothy hay, and corn stover; the other, shelled corn, gluten meal, timothy hay, and corn stover. From this it will be seen that no nitrogenous roughage like clover hay was used. The results were as follows:

FINANCIAL STATEMENT

Lot 1. Corn, timothy hay, and corn stover.

DISBURSEMENTS

To 12 steers, 11,610 pounds at $3.80 per cwt	$441.18
To 225.7 bushels corn at 35c. per bushel	78.99
To 7.59 tons corn and cob meal at $11.44 per ton	86.83
To .41 ton cornmeal at $13.34 per ton	5.47
To 5.37 tons timothy hay at $10.00 per ton	53.70
To 3.17 tons corn stover at $4.00 per ton	12.68
Expense of feeding in holding last week	13.57

Freight, Champaign to Chicago, commission for selling, and other expenses	30.00
Total disbursements	$722.42

RECEIPTS

12 steers, 14,063.04 pounds at $5.35 per cwt	$752.37
482 pounds pork at $5.00 per cwt	24.10
Total receipts	$776.47

Total disbursements, $722.42; profit on twelve steers, $54.05; profit per steer, $4.50.

Lot 2. Corn, gluten meal, timothy hay, corn stover.

DISBURSEMENTS

To 12 steers, 11,702 pounds at $3.80 per cwt	$444.68
To 138.27 bushels corn at 35c. per bushel	48.39
To .64 ton cornmeal at $13.34 per ton	8.54
To 6.62 tons corn and cob meal at $11.44 per ton	75.75
To 2.09 tons gluten meal at $29.00 per ton	60.61
To 5.96 tons timothy hay at $10.00 per ton	59.60
To 3.18 tons corn stover at $4.00 per ton	12.72
Expense of feeding in holding last week	15.42
Freight, Champaign to Chicago, commission for selling and other expenses	30.00
Total disbursements	$755.69

RECEIPTS

12 steers, 14,880 pounds at $5.80 per cwt	$863.04
422 pounds pork at $5.00 per cwt	21.10
Total receipts	$884.14

Total disbursements, $755.69; profit on twelve steers, $128.45; profit per steer, $10.70.

The foregoing financial statement clearly shows that in this test where corn was fed with timothy hay and corn stover there was a marked advantage in the feeding of gluten meal. Similar results would have followed the use of oil meal or cottonseed meal in the ration. The results are so striking that it leaves little doubt as to the advisability of purchasing these concentrated feeds where alfalfa, clover hay, or cow-pea hay are not available as a supplement to corn for cattle feeding.

AMOUNT TO FEED

Where oil meal or cottonseed meal is to be fed there are several questions arising which should be briefly considered. How much of these commercial concentrates should be fed per animal per day, and how rapidly should steers be worked up to the amount to be fed? Experience has demonstrated that if one wishes to get the largest net profit from feeding these feeds a minimum rather than a maximum amount should be used, that is, the feeding of two to three pounds per steer per day is likely to be followed with larger net profits than the feeding of five or more pounds per steer per day with feeds at normal prices. The amount that can be fed to advantage will, of course, vary with the composition of the remainder of the ration. For example, if alfalfa and clover hay are used as roughage and the feeding of these concentrates is largely a matter of increasing the value of the manure, then the maximum amount fed should not exceed three pounds per day per 1000 pounds live weight of cattle, and it is even possible that the most profitable returns are secured by feeding even smaller amounts. Where timothy hay, corn stover, or straw is used for roughage and corn for the concentrated part of the ration, this three pounds becomes the minimum amount of oil meal, cottonseed meal, or gluten meal to be fed daily per 1000 pounds live weight of cattle. When corn is high in price and these feeds reasonable, as much as four pounds may be fed to advantage. These amounts are suggested for two-year-old or older cattle. For calves or yearlings one pound per 1000 pounds live weight of cattle more than that stated for older cattle will be found a good rule to follow. Cattle should be started on these feeds at the rate of one-fourth pound per day per animal, increasing them at the rate of one-eighth pound per day until the cattle receive the required amount.

HOGS FOLLOWING STEERS FED COTTONSEED MEAL

Much has been said concerning the danger to hogs following steers fed on cottonseed meal. Undoubtedly this danger has been greatly exaggerated. The writer has yet to learn of a single instance of injury to hogs following steers fed cottonseed meal in the amounts recommended above, where reasonable care was exercised in not allowing the pigs access to the meal before it passed through the cattle.

SUMMER FATTENING

While cottonseed meal furnishes an excellent supplement to the corn plant for winter fattening of steers it can be used to greater advantage as a supplement to corn in fattening cattle on grass. As to palatability, oil meal comes first, then cottonseed meal and gluten meal in the order named. If whole corn is to be supplemented, either the pea or nut size of ground linseed cake or the nut size of cottonseed cake should be used; especially in summer are these sizes recommended, because there is less waste from high winds. The highest grades or best brands of these feeds are advised. Cattle feeders are frequently urged to purchase low-grade concentrated feeds, the inducement of a lower price being the alluring argument that frequently accomplishes the end sought. The observation of the writer has been that in most instances the purchaser of such grades is distinctly the loser.

AT WHAT STAGE TO FEED

The question is frequently asked, where these concentrated feeds are to be fed only a part of the time, at what stage of the fattening process can they be used to the best advantage? The commonly accepted practice of the best feeders counts for much, and their almost universal practice is to use it during the last sixty days prior to marketing. This method has much to commend it, as it improves the appetite at a time when

it needs quickening, and when it is good practice to feed a heavy ration of highly concentrated feeds. It gives a finish to the hair and skin that attracts buyers. An experiment is needed to determine whether or not these same ends would be reached and time saved in the fattening by feeding the oil meal or cottonseed meal during the first rather than the last part of the feeding period; and, again, whether the meal to be fed during the last sixty days would not accomplish more if distributed in smaller daily rations throughout the whole of the feeding period. The writer has observed that there is a very marked difference in the way cattle getting oil meal and those that do not, go on feed. Those getting corn only seem to start much more slowly than those getting some nitrogenous concentrates from the beginning.

OATS IN CATTLE FEEDING

Oats are an excellent food for fattening cattle when the price will permit their use, but their feeding value, pound for pound, is no higher than that of corn, hence they can not be used extensively when higher in price per pound than corn. Being rather bulky, they are good to mix with cornmeal in the absence of the cob or other bulky material. They are not as fattening as corn and should be used as a supplement to rather than a substitute for corn. They make an excellent food for growing stock. Oats are valued very highly by a large number of cattle feeders to supplement corn in starting calves intended for finishing as baby beeves.

MOLASSES

Molasses is strictly a carbonaceous food, belonging in the same class as corn and similar feeds. It has come to be regarded as a valuable feed for fattening cattle, especially in the sugar-producing regions of the country where it is obtained cheaply as a by-product from the manufacture of sugar. In the manufacture of sugar it is impossible to get all the sugar to crystallize out of

the cane or beet juice, and this sugar, together with other organic matter contained mainly in the form of proteids, gives the refuse molasses its value as a stock food. The protein, however, is in a very small proportion as compared with the sugar or carbohydrates. This refuse is obtainable in the sugar belt for from six to ten cents a gallon of about twelve pounds.

For fattening cattle molasses has as much or more value as an appetizer than as an actual food. When sprinkled over grain or hay it causes a larger consumption of feed, and not only this, but feeders claim that it is an aid to digestion. Although at present there is not much data at hand on the subject, this claim seems to be substantiated by experimental evidence. An experiment conducted by the Texas Station in 1903 shows that when molasses at the rate of two-fifths of a gallon per steer per day was added to a ration of cottonseed meal and cottonseed hulls, the cattle not only made a greater daily gain per head, but the gains were made cheaper. (Texas Bulletin 76.)

A bulletin on the subject has been published by Professors John A. Craig and F. R. Marshall of the Texas Station, which gives the results of feeding molasses to two-year-old steers being finished for market. The average grain ration consisted of 14 pounds of cottonseed meal and corn chop, one part of the former to two parts of the latter, and the average roughage consumed was 12½ pounds of cottonseed hulls per day. To this was added molasses at the rate of a little over 3 quarts per steer per day. The cattle thus fed made an average daily gain of 1.71 pounds against 1.27 pounds with a similar lot similarly fed, but without the molasses. The cost per pound gain was 10.05 cents with the lot receiving molasses against 11.3 cents with the lot receiving no molasses. The low rate of gain and high cost per pound is due to the fact that the steers had been long fed and were nearly fat when the experiment began.

The bulletin referred to states that the most common method of feeding molasses is to carry it out in buckets and mix with the feed in the bunks. In the tests at the station the molasses was mixed with an equal volume of water and poured over the mixed grains and hulls, the whole then being thoroughly stirred. A common practice is to take a spraying outfit, the barrel being filled with an equal volume of water and molasses, and drive through the feed lot, spraying on the mixed feed in the bunks such an amount of the mixture as is to be fed. According to statements made by the Massachusetts Station, the residuum molasses from Porto Rico is being offered for sale in New England at 13 cents a gallon of 12 pounds. The molasses contains 24 to 28 per cent of water, 3 per cent of nitrogenous matter, and 7 to 8 per cent ash, the remainder being sugar and allied substances. "It will probably be shown to contain some 1200 pounds of digestible organic matter in a ton, against 1500 pounds in a ton of cornmeal. On this basis alone it would have, pound for pound, 80 per cent of the nutritive value of corn. Its value will probably be enhanced over this figure, because of its other desirable qualities."

A good appetizer is made of ground alfalfa hay mixed with molasses. Mr. T. B. Hord, Central City, Nebraska, claims that such a mixture fed at the rate of two pounds per day increased the consumption of corn from three to six pounds per day per steer.

ROUGHAGE IN CATTLE FEEDING

ALFALFA AND CLOVER HAY COMPARED WITH OTHER ROUGHAGE

It is generally known that alfalfa and clover hay are superior roughages for cattle. The writer is inclined to believe that the extent of this superiority is not as generally appreciated as it should be, else more alfalfa and clover and less timothy and other grasses would be grown for feeding purposes. The writer has been

unable to find any published data concerning the relative value of alfalfa and clover hay when used with corn for fattening cattle. Cattle feeders who have had experience in feeding both are, however, practically unanimous in their belief that alfalfa is the better roughage of the two. One factor which materially contributes to this fact is that alfalfa contains 11 pounds protein in each 100 pounds hay, while red clover contains only 6.8 pounds. Another fact to be reckoned with is that alfalfa is not as much damaged by storms during the curing process as is clover. Wheat bran contains but 12.2 pounds protein per hundredweight and, as far as its content of protein goes, is but little more valuable for feeding purposes than is alfalfa. Timothy hay contains 2.8, corn stover 1.7, and oat straw but 1.2 pounds protein per hundredweight. Thus it will be seen that as far as we are able to judge from the chemical composition of these feeds they are not well suited to supplement corn, which contains 7.8 pounds protein per hundredweight. Experience and experiment both corroborate the chemists' claims.

TEST MADE AT THE ILLINOIS STATION

In an experiment at the Illinois Experiment Station, some important facts bearing directly upon this subject were brought out. Clover hay was compared with timothy hay and corn stover when used with corn for fattening two-year-old cattle. It took 7.68 pounds corn and 4.82 pounds clover hay to produce 1 pound of beef in the clover hay fed lot, as compared with 9.87 pounds corn and 5.88 pounds timothy hay and corn stover combined. Or, taking into consideration the meat (both beef and pork) produced, the figures stand as follows: 6.75 pounds corn per pound gain on steers and pigs combined in the clover hay lot, as against 8.47 pounds in the timothy hay and corn stover lot. There were twelve steers in each lot, and they were fed eighteen weeks. In the clover hay lot $272.08 worth of feed

(figured at normal prices, 35 cents for corn and $8 for clover hay) produced a gain of 3605 pounds (Chicago weight) on the steers and 542 pounds on the hogs, while in the timothy hay and corn stover lot $251.24 worth of feed produced only 2498 pounds gain on steers and 482 pounds on the hogs.

The records of this experiment clearly show the relatively greater efficiency of the corn and clover hay ration as compared with the corn, timothy hay, and corn stover ration for beef production. That the advantages of the former were due entirely to the nature of the roughage fed is probable since corn was the concentrate used in both instances. Notwithstanding the fact that the corn and clover hay ration was more effective for beef production, it appeared also to be very favorable to pork production, as much more pork was produced by the pigs following this lot of steers and more pork per pound grain fed to the steers than where timothy hay and corn stover made up the roughage part of the ration.

CLOVER HAY AND CORN MAKE GOOD GAINS

As would be expected from a comparison of the gains made in the two lots, the steers in the lot making the largest gains were more nearly finished than the others. That is to say, the lot fed on corn and clover hay sold for 30 cents per hundredweight more than the lot fed on corn, timothy hay, and corn stover. The shrinkage in shipping from Champaign to Chicago per steer in the former lot was but 35 pounds to the latter's 41. With corn at 35 cents per bushel, clover hay at $8 per ton, timothy hay at $10, and corn stover at $4, the profit per steer in feeding the rations discussed above was for the corn and clover hay lot, $11.89; for the corn, timothy hay, and corn stover lot, $4.50. This should be sufficient argument to encourage the growing of clover or alfalfa for cattle feeding purposes. The two-year-old cattle used in this test contained considerable Shorthorn blood, but would not grade above medium to good and ordi-

narily could be purchased in the fall of the year for $3.80 per hundredweight delivered in the feed lot and would sell in the condition in which these were marketed at from $5.35 to $5.65 per hundredweight on the Chicago market.

At the Missouri Experiment Station 157.5 bushels of corn and 2540 pounds of timothy hay made a gain of 789 pounds in 105 days on four steers, or an average daily gain of 1.97 pounds. Each bushel of corn in this case made a gain of 5 pounds.

One hundred and seventy-six bushels of corn, 2475 pounds of clover, and 868 pounds of corn stover made a gain of 1140 pounds in the same time, or an average daily gain of 2.85 pounds. Here a bushel of corn averaged to produce 6.74 pounds of gain in weight.

One hundred and sixty-nine bushels of corn, 2967 pounds of clover, and 1139 pounds of wheat straw produced a total gain of 1073 pounds, or 2.68 pounds per day. A bushel of corn made with this combination 6.08 pounds of gain. These results apply with even greater force to calves than to yearlings and two-year-old cattle.

CORN STOVER

In both composition and digestibility corn stover closely resembles timothy hay, and the edible portion of the stover has a nutritive value fully equal to that of timothy. The Illinois Experiment Station (Bulletin 58) found the digestion co-efficients for the various nutrients in corn stover to be as follows: dry matter, 58.2 per cent; ash, 22.5 per cent; protein, 37.4 per cent; fat, 55.2 per cent; fiber, 70.3 per cent; carbohydrate extract, 60.6 per cent. These are averages of results obtained from feeding four steers for a period of ten days.

In the system of handling the corn crop practiced throughout the corn-belt, namely, that of husking from the stalk and using the stalk fields for pasturing cattle in the winter, considerable of the feeding value of the crop is wasted.

Corn stover may be used to the best advantage when fed to stock cattle, sheep, or horses. It is not a desirable feed for beef production, especially when fed in connection with corn, which is a highly carbonaceous ration in itself. It may be advantageously used to supplement an inadequate supply of better roughage, such as clover or alfalfa hay.

CHAFFING HAY AND MINGLING WITH GRAIN

It is held by some cattle feeders that by cutting the hay into short lengths and mixing it with the grain, more thorough mastication and digestion are secured with less liability of digestive derangements and more economical use of feed. Experiments, however, do not sustain this theory. At the Illinois Experiment Station four lots of choice 1000-lb. feeders of fifteen head in each lot were fed six months in a dry feed lot from December to June as follows:

Lot 4, cornmeal, linseed oil meal, gluten meal, and clover hay.

Lot 5, cornmeal, linseed oil meal, gluten meal, and chaffed clover hay mingled with the grain.

Lot 6, corn and cob meal, gluten meal, oil meal, and clover hay.

Lot 7, corn and cob meal, gluten meal, oil meal, and chaffed clover hay mingled with the grain.

The chaffing of the clover hay was done by running it through an ensilage cutter. The actual cost of chaffing was $1.00 per ton, which included labor, and wear and depreciation of machinery. The results are summarized as follows:

Lot No.	Total gain per steer, lb.	Gain per steer per day, lb.	Pork made per steer, lb.	Dry matter per pound gain on steers, lb.	Profit per steer
4	442.86	2.38	20.66	10.43	$5.99
5	434.14	2.33	20.02	10.71	4.50
6	432.03	2.32	18.00	11.75	4.34
7	455.94	2.45	24.00	11.31	5.78

The feeding of chaffed hay with cornmeal seems adverse to large gains as compared with feeding clover hay in the ordinary way. In feeding chaffed hay with corn and cob meal the effect seems to be favorable to the use of chaffed hay for securing rapid gains. These differences, however, are so slight that it is safe to say that the mere chaffing of the hay and mingling it with the grain has but little, if any, influence on securing rapid gains.

The chaffing of hay and mingling it with the concentrates in the form of meals did not add materially to their efficiency for beef production, although by this system of feeding there is less likelihood of getting the steers off feed or of their scouring.

The Kansas Experiment Station conducted a similar experiment, the results of which were not markedly favorable to chaffing and mingling, but they were more favorable to this practice than were those of the Illinois test.

Professor Henry says in "Feeds and Feeding," that in the case of hard-worked horses it is advisable to chaff the hay and mix it with the grain and moisten the whole mass. This puts it in shape to be quickly masticated and swallowed, and has a longer time to remain in the stomach for digestion than would be possible where long dry hay is fed. But in the case of fattening cattle and farm stock in general, which have ample time for mastication, there is little or no advantage in chaffing hay or straw.

It is quite probable that the chaffing of hay and mingling it with the grain in proper proportion is conducive to a smoother and more attractive finish on the cattle.

FOR GETTING CATTLE ON FEED QUICKLY

Although there seems to be but slight advantage in chaffing hay and mingling it with grain for cattle fed for the ordinary fattening period, when the mixed hay

and grain ration is fed through the self feeder to cattle that are to be fed for a short period only, such cattle can be put on full feed much quicker and at a less risk than when fed in the ordinary way. This has been well illustrated in an experiment conducted at the Illinois Experiment Station. A number of good to choice fleshy three-year-old feeders were selected and divided into two lots of fourteen each, and fed for a period of 89 days. Lot 1 was fed corn meal, oil meal, and clover hay by the ordinary method of hand feeding. Lot 2 was fed on the same feed-stuffs, but the clover hay was cut into two-inch lengths and mingled with the grain and the mixture was fed through a self feeder, to which the cattle had access at all times. The full grain ration was reached by gradually increasing the proportion of concentrates to roughage. Both lots were given all the grain they would consume without causing digestive disorders and getting them off fed. The entire feeding period was divided into six periods of two weeks each. The proportion of concentrates to roughage for the different periods is shown by the following table:

Lot	Periods						Average 89 days
	1	2	3	4	5	6	
1	1 : 1.64	1 : 0.67	1 : 0.72	1 : 0.55	1 : 0.43	1 : 0.34	1 : 0.61
2	1 : 1.29	1 : 0.71	1 : 0.51	1 : 0.38	1 : 0.36	1 : 0.33	1 : 0.51

There was quite a marked difference between the two lots in the time required to reach full feed, the total amount of feed consumed, the proportion of concentrates to roughage, and the rate and cost of gains, the difference in every case being in favor of Lot 2. The maximum concentrate consumption was reached in the fourth period in the case of Lot 2, while with Lot 1 it was not reached until the fifth period, showing that Lot 2 was on full feed about two weeks sooner than Lot 1. There was a larger total consumption of feed in Lot 2

than in Lot 1, especially of concentrates, the average daily grain ration of Lot 1 was 21.97 pounds, against 24.64 pounds in Lot 2. The average daily consumption of roughage was .67 of a pound greater in Lot 1 than in Lot 2, but as the digestible nutrients were more expensive in the form of roughage than in the form of concentrates, it is probable that this larger proportion of roughage would work as a handicap in the cost of gains for the lot. Lot 2 made larger and more economical gains than Lot 1. The average daily gain for Lot 1 was 2.984 pounds, at a cost of $0.0753 per pound against the average daily gain of 3.326 pounds at a cost of $0.0749 per pound by Lot 2. The profit per steer in Lot 1 was $1.288 and $3.403 in Lot 2.

These figures show that by chaffing the hay and mingling it with the grain and feeding through a self feeder, the cattle were put on full feed sooner, consumed a larger amount of feed, and made larger and more economical gains than when fed in the ordinary way. Although such marked results may not be obtained in all cases, this experiment was carried on under natural conditions and there is no reason why it should show results especially favorable to chaffing.

CHAPTER IX.

BABY BEEF

The demand for baby beef is strong and increasing. With this increasing demand of our markets for this class of beef there is a general movement among cattle feeders, and more especially among those who have limited experience, toward the feeding of younger cattle.

We do not mean by this that only the inexperienced are taking up the production of baby beef. It is but natural that cattle feeders of wide experience should be inclined to continue to follow those methods which they have found profitable and accept slowly new methods and ideas of cattle feeding. On the other hand so much has been said and written concerning the advantages of producing baby beef that the beginner arrives at the conclusion that it is the only profitable branch of beef production.

There are many things to be thought of, however, before the cattle feeder rushes blindly into the feeding of calves and yearlings with a view of finishing them as baby beeves. The majority of fat cattle falling within this classification are from one to two years of age and weigh from 800 to 1100 pounds. Such cattle can only be produced from well-bred calves and yearlings. Whether or not the finishing of such cattle will prove profitable will depend upon a number of conditions, chief among which are the breeding and individual excellence of the feeding cattle used, their cost, the way they are fed, and the condition of the market at the time they are sold.

MUST BE WELL-BRED YOUNGSTERS

Other things being equal, the younger the cattle the longer it will take to mature them for market. Well-bred feeding cattle can be matured for market at a much younger age than the plainer kinds. One thing is certain, baby beef must be made with young cattle. Only well-bred ones will mature sufficiently early to satisfactorily meet market requirements. It should be borne in mind, too, that, provided care has been exer-

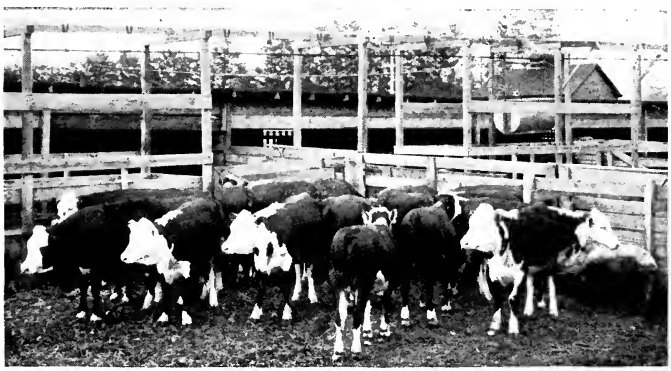


Fig. 7. The right quality with which to produce baby beef.

cised in the selection of feeding calves or yearlings with which to make baby beef, the period of full feeding must of necessity be considerably longer than with older cattle.

It is necessary to exercise greater care in the selection of feeding cattle intended for ripening into baby beef than older cattle for the reasons already stated and for the additional reason that the younger an animal is and the more milk fat it possesses, the less it shows its lack of quality or breeding. By the time a steer is two years old one can tell quite accurately how such steers will feed out. It is a much more hazardous propo-

sition with the calf. We have fed calves that were selected with the greatest care as to breeding, age, and uniformity and still found that they lacked much in uniformity at the finish.

In a general way it may be said that to fatten young animals profitably they must be good, they must be full fed for a considerable time, and they must be made fat. This means that "tops" must be bought or bred. Those who have had experience know that as soon as the cattle feeder goes to "topping" droves of cattle he operates at a disadvantage. A premium is usually demanded for this grade. The cattle feeder should know what he can afford to pay and not give too much heed to the oft-repeated statement that good calves cannot be bought too high. One way of becoming thoroughly convinced that this is not true is to try it.

SPREAD IN PRICES NARROWER

The original weight of the calf is small, hence in the production of baby beef the cattle feeder cannot depend for his profit upon the advance in value per hundred weight upon the original weight. In any event the spread between the buying and selling price of calves is not as great as with older cattle. We have known of a number of instances in which calves were purchased by the head and sold fat by the hundredweight where the selling price was no greater than the buying price per hundredweight. If any considerable profit is made in such instances it must necessarily be due to exceedingly cheap gains. The possibility of securing cheaper gains on young cattle than on older ones is an established fact, yet the writer has strong reasons for believing that this difference has been greatly exaggerated.

Profitable baby beef production requires experience, judgment, and skill of a high order. It is a mistake for the inexperienced to dip heavily into this enterprise.

The most successful operators try to avoid losing

the calf or milk fat or bloom of the young calf. This is not an easy thing to do. Usually considerable shrinkage occurs, especially where calves have not been accustomed to eating grain before being weaned. Where considerable shrinkage in condition occurs it is difficult and expensive to regain, not only so, but it materially lengthens the time required to mature them. The calf will not profitably consume so much rough feed as older cattle. Experienced cattle feeders understand

Fig. 8. High class "baby beef" bred and fed by D. R. Perry & Son, Sanford, Ill.

that the older the steer the coarser and commoner the feed that can be given him. The older steer may be purchased in thin flesh and yet matured in six months of feeding; the calf or yearling not so. The calf should be in good condition when purchased and should be so fed as to keep him gaining until finished for the market.

ROUGHAGE INCREASES FEEDING CAPACITY

At the beginning the calf should be encouraged to consume considerable quantities of roughage. This will have a tendency to increase the capacity of the calf

for handling large quantities of more concentrated feeds later on. It is assumed that calves require and will be provided with desirable roughage such as clover, or alfalfa hay, or silage during the winter months and abundant pasture during the summer. Calves should be fed corn together with some nitrogenous concentrate like oil meal or cottonseed meal during the winter. Corn may be fed to calves in the form of shelled corn, crushed corn, or sliced. With plenty of hogs to follow,

Fig. 8A. Baby beeves possessing desirable quality and finish. Fed by Hon. Humphrey Janes, Washington Court House, Ohio.

the writer believes that these forms will be found more profitable than cornmeal or corn and cob meal. If oats are cheap and more readily available than oil meal or cottonseed meal they may be substituted. Oats are one of the very best of feeds with which to start calves, and with cottonseed and linseed meals at almost prohibitive prices, they, with alfalfa or clover hay as roughage, are likely to prove the best supplement to corn for full feeding. When turned to grass the grain ration may in some instances be gradually decreased as the grass improves. Whether or not the feeding of grain should be altogether dispensed with for a short time while the calves are on grass will depend upon the grass and upon

the time at the disposal of the cattle feeder for finishing them. Ordinarily the grain ration should not be entirely discontinued, no matter how good the grass. It can be slightly reduced for a few weeks and then as the grass begins to fail it should be increased until the calves are getting all they will take.

LIBERAL FEEDING IS NECESSARY

The tendency with calves and yearlings is to grow rather than fatten. The aim of the cattle feeder producing baby beef should be to have them fatten as they grow. This can only be accomplished by liberal feeding. The most common mistake among baby beef producers is to market before fat enough. It is extremely difficult to get calves and yearlings too fat for market requirements. If heifer calves are fed instead of steers they will mature more quickly and should be marketed earlier. Ordinarily the younger prime heifers are at the time of marketing, the less discrimination in price there will be between them and steers.

We advise vaccination to prevent blackleg, and if calves have not been vaccinated before purchase they should be as soon after as possible. Good vaccine and intelligent use are practically a specific preventive of blackleg.

It is seldom practicable to get spring calves ready for baby beef market before July of the second summer. More frequently they are not marketed until October, November, or December, when they are approximately eighteen months of age.

CHAPTER X.

SELECTING CATTLE FOR, AND THE POSSIBILITIES OF, THE SHORT FEED

Undoubtedly the system of feeding cattle a relatively short time, making it possible to handle several different droves a year is becoming more popular. In addition to the advantage of being able to handle more droves each year is the possibility of avoiding the long and necessarily expensive fattening periods. On the other hand the disadvantages of such a system are not wanting, chief among which are the impossibility of making finished beeves of a high grade, the difficulty of securing suitable stock, and a growing and marked tendency among buyers to strongly discriminate against short-fed cattle. In reality there are two kinds of short feeds, viz., (*a*) buying noticeably thin fleshed cattle with considerable age, shipping them to the country, and returning them to market in about ninety days after liberal grain feeding. This is a practice commonly spoken of as "warming up." This system deals very largely with cattle of low grade or those plain in quality. (*b*) The purchase of fleshy cattle of strong weights that have been shipped to market, for one reason or another in a half fat condition. Cattle that are good enough so that packers buy them for slaughtering purposes, not bidding them high, as they are not fat enough to suit the trade demanding choice beef for which those demanding it are willing to pay top prices. Those who have made the greatest success of this method of feeding have had unusual facilities for buying and marketing. Skilled feeding is necessarily an important feature of the business, but after all is said, the success of the enterprise must rest largely in judicious and timely buy-

ing and marketing. Cattle feeders who do not have these advantages would better leave this branch of the business to those who have.

Commonly, about one-third of the margin per hundredweight necessary to balance accounts in case of feeding cattle bought on the market and returned to be sold there after fattening, is due to freights, commissions, and stock yards charges. Hence the shorter the fattening period, the larger is the relative importance of these buying and marketing expenses. Thus it is not difficult to see that the difference in distance from the market, causing differences in freight rates, may properly affect the nature of cattle feeding practice advisable. It should be obvious that nearness to market should be favorable to a system of short feeding. Perhaps the factor of greatest importance in selecting cattle for this purpose, assuming whatever purchased to be worth the price paid, is to get cattle that have as much age as possible. Cattle under two years old should seldom if ever be selected for short feeding purposes, and three-year-olds are to be preferred to younger cattle. If the cattle are purchased with a view of "warming them up," a decided lack of flesh, providing they are thrifty, is to be desired, while if purchased with a view of making a good to choice grade of beef, fleshy feeders or cattle that some other feeder has "warmed up" should be purchased. In both instances, but more especially in the latter, as good quality or breeding in the steers should be secured as is available at right prices. Weight, always an important factor in buying feeding cattle, is especially important in buying cattle for a short feed.

HOW TO FEED

No matter what method of getting cattle on feed is advisable where cattle are to be fed for a considerable time, for short feeds they must be put on feed quickly and fed on a heavy, highly concentrated ration. Elsewhere it has been stated that the safest and most satis-

factory method of getting cattle on feed quickly is to chaff the hay and mingle it with the grain. This is not always practicable, but where at all possible it is to be advised.

POSSIBILITIES OF THE SHORT FEED

The possibilities of the short feed have been demonstrated by an experiment conducted at the Illinois Experiment Station. Thirty-four good to choice fleshy three-year-old steers were purchased on the Chicago market August 22 and taken to the University of Illinois, where they were fed until November 25, a period of eighty-nine days. On the basis of weights taken after their arrival at Champaign after being shipped from and before being shipped back to Chicago, the steers made an average daily gain of 3.15 pounds for the eighty-nine days. The average feed per steer per day was: corn meal, 20.28 pounds; oil meal, 3.02 pounds; and clover hay 13.11 pounds.

The steers cost $4.25 per hundredweight on the Chicago market, and, taking into consideration the freight to Champaign, shrink, commission, and feed, the cost in the feed lot at the beginning of the experiment was $4.45 per hundredweight. The financial result of the experiment is shown by the following statement:

DISBURSEMENTS

To Cattle:		
34 steers, 36,490 lb. at $4.25 per cwt.	$1550.82	
Commission	20.00	
Freight	41.88	
Feed prior to experiment	4.00	
		$1616.70
To Feed:		
30.698 tons cornmeal at $13.699	$420.53	
4.589 tons oil meal at $28.00	128.50	
10.175 tons clover hay at $8.00	81.40	
9.661 tons clover hay chopped at $9.00	86.95	
		717.38

To Marketing:

Freight Champaign to Chicago, commission, feed, and yardage	76.88
Total expenditures	$2410.96

RECEIPTS

34 steers, 44,650 lb. at $5.60 per cwt.	$2500.40	
465 lb. pork at $5.00 per cwt.	23.25	
Total receipts		$2523.65
Profit on 34 steers		112.69

This shows a profit of $112.69 with corn at 30 cents per bushel and other food-stuffs as charged in the account. No account was taken of labor and interest on money invested, or fertility produced.

CHAPTER XI.

MAKING CHRISTMAS BEEF

The fattening of cattle with especial reference to their fitness for Christmas market requirements has become a speciality among quite a large number of cattle feeders. While the demand for Christmas beef is limited it has thus far been sufficiently extensive to absorb the supply offered and that at good prices. The prices paid in the leading markets for prime Christmas beef look attractive to the average beef producer who is not very closely in touch with market conditions. These prices frequently tempt men to feed cattle for this particular market that are not at all suited for the trade. The good prices are only paid for the prime cattle and to make prime cattle requires careful attention to every detail of the enterprise, including the selection of the feeding cattle to be finished and the fattening of them. It requires skill of a high order to produce cattle that are good enough in quality and condition to attract buyers during the holiday season. The production of such cattle is by no means an easy or sure way to secure profits in the cattle feeding business. It requires choice to fancy quality in feeding cattle to begin with, and it is but seldom that such cattle can be purchased except at a premium. Then, frequently, it is desirable in order to secure the highest finish to feed some nitrogenous commercial feeds which are relatively high priced, and lastly, in order to secure the high finish demanded requires an extended feeding period. The experienced cattle feeder recognizes at once that the factors enumerated above each increase materially the cost of production. This increased cost amounts to considerable when all these factors are combined.

The so-called Christmas market for such cattle is made by three classes of buyers. Buyers for local slaughter, as, for example, in the Chicago market the packers; order buyers for shipment to other cities; and exporters. The proper time to market Christmas cattle is from about November 23 to December 15. Between these dates buyers for local slaughter, shipment, and export are on the market until their orders are filled. Exporters who buy for the foreign holiday trade usually

Fig. 9. Prime standing rib of Christmas quality.

buy most of their cattle from November 25 to 27, although these dates may vary a little one way or the other, depending upon the days of the week on which export boats sail for foreign ports. Ordinarily, exporters take from one-fourth to one-third of the total supply of Christmas cattle offered on the Chicago market. The larger proportion of holiday beef is exported alive, and for this purpose cattle possessing fancy quality and thick fat, weighing from 1300 to 1500 pounds are wanted. From 1300 to 1400 pounds is the popular weight, although they use some prime 1100 to 1200 pound cattle for that trade and a few weighing as much

as 1600 pounds. For the New York and Eastern holiday trade, the first ten days of December, especially from the fifth to the eighth, is considered a favorable time to market; for the Chicago city trade and nearby cities and towns, from December 10 to 15.

New York, Boston, and some other Eastern cities use more heavy good weight cattle than the Western cities. They also use a good proportion of yearlings and light weights, and the light and medium weight prime cattle

Fig. 10. A high-class porterhouse steak. An expensive cut, but good

seem to be getting more popular every year. It has been intimated that the supply is not as large as it would be if it were not a difficult matter to produce prime Christmas bullocks. The accompanying illustrations will give the reader an idea of the quality or grade demanded by discriminating buyers of Christmas beef, the grade of cattle which produce it, and lastly the kind of feeding cattle it is necessary to select if one expects to achieve success in the production of Christmas beef.

Figure 9 shows a standing rib (from which are cut prime of rib roasts). Here the distribution of fat and lean is ideal, showing sufficient richness without much waste. Figure 10, the porterhouse steak, is at best an expensive cut, but where the fat is as abundant as

Fig. 11. The right quality with which to produce Christmas beef.

shown here it is extremely so, although it is a high class sample of a Christmas porterhouse steak.

The prime steers which are slaughtered to supply the demand for this grade of beef are invariably well bred. No dairy-bred or scrub steer need apply. They will receive no consideration. By "well bred" we mean steers which contain a high percentage of the blood of some of the improved beef breeds like the Aberdeen-Angus, Shorthorn, Hereford, Galloway, or Polled Durham. Nor is the possession of beef blood in abundance a passport to this exclusive class Beef blood in abundance they must have, but it must be accompanied with the characteristics associated with highest excellence of such grades.

Figure 11 illustrates the quality and the individual excellence necessary in feeding cattle suitable for the production of Christmas beef. With quality similar to this to start with and thorough familiarity of the cattle feeding problem, the farmer is equipped with the essentials for producing Christmas beef. Whether or not such production will result in profit will depend upon the cost of the feeding cattle and feeds used, the skill of the feeder, and the state of the market at the time they go forward to market. It should be emphasized that the making of Christmas cattle is a costly business and not at all well calculated to yield large profits if indeed any at all to the novice. It is a business that is hazardous at best and a goodly portion of those who follow it do so from a spirit of rivalry or pride. Those who make it pay are experienced cattle feeders of long standing.

Figure 12 shows satisfactory prime quality and condition in cattle for the Christmas market.

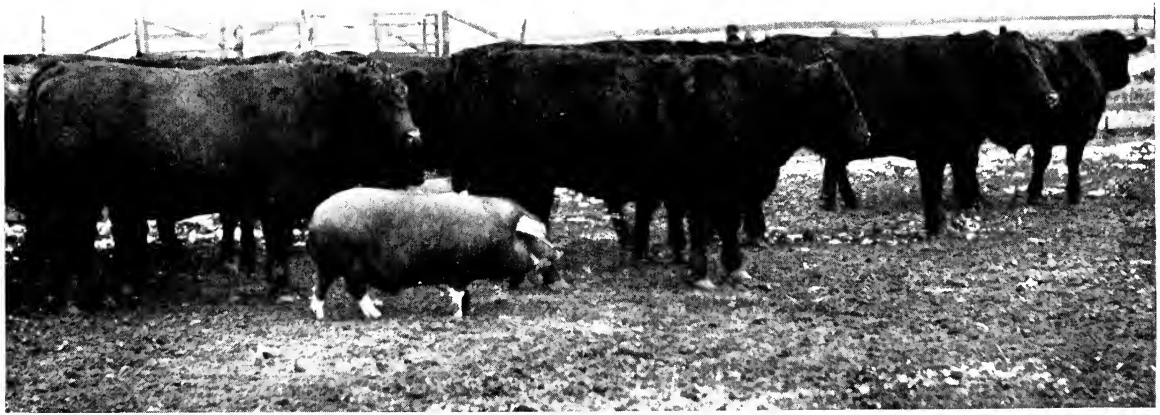


Fig. 12. Satisfactory prime quality and condition for the Christmas market. Fed by George F. Manderson, Yale, Ia.

CHAPTER XII.

CARE OF CATTLE ON FEED

The care of cattle on feed is an important factor. By care we refer to a number of little details which are not ordinarily included in discussing methods of feeding, rations, or equipment. These include among other things, regularity in feeding, quietness, number of times a day to feed, the number of cattle to be fed together, and salting. In feeding it should be remembered that fattening cattle soon become accustomed to looking for their feed at certain hours in the day, and if it is not supplied at the regular time the cattle become uneasy and worry. It is unnecessary to say that this cause for worry among cattle should be avoided. As soon as the fattening process begins, the cattle should be fed at certain hours and in the same way. This time cannot be varied fifteen minutes without some detriment to the cattle. The extent of injury will depend upon the frequency and extent of irregularities.

IMPORTANCE OF QUIETNESS

The quietness of manner of the feeder is also an important consideration. The even-tempered attendant who is quiet in manner and movement invariably proves more satisfactory than the erratic, bustling, noisy one. The cattle soon learn to have confidence in the former and welcome his coming among them, while they are always suspicious of the latter, never feeling quite at ease when he is in sight. Under the management of the former, the cattle become tame and quiet, even though more or less wild at the outset; while under the latter, wild cattle become wilder and tame cattle become timid. The writer has observed a wide difference in

practice among feeders as to their manner of approaching fattening steers. Some are brusque in manner, rushing up to the steers and scaring them up quickly, while other (and I am bound to say more successful) feeders approach the cattle with the greatest care and consideration, getting the cattle up, if at all, as quietly as possible. Pastures for cattle in quiet, secluded places are more valuable for fattening cattle than are those adjacent to public roads or adjoining pastures where horses or breeding cattle run.

A FLY PREVENTIVE

Flies are a great drawback to successful summer feeding. Fattening cattle may be partially protected from them by furnishing the cattle with a cool, dark shed to run in during the heat of the day, the doorway to which is provided with strips of burlap hung at the top of the doorway and extending low enough to strike the backs of the cattle as they pass into the shed. The painting of these sheds white is recommended by some practical feeders as one means of making them more cool than they would be were the exterior painted red, or some other dark color, or not painted at all.

GROOMING

Grooming of fattening cattle is a practice of doubtful advisability. It has been practiced only to a limited extent, and then usually with show cattle. To the writer's knowledge, some cattle feeders advocate and practice, with apparently good results, the tacking up of grooming cards in convenient places about the feed lot where the cattle perform their own grooming in a more or less crude fashion. It is only necessary for the cattle feeder to tack up a few of these cards to become convinced that the cattle will use and enjoy them.

NUMBER OF TIMES A DAY TO FEED

The majority of cattle feeders prefer feeding their cattle grain and roughage twice a day in winter and

grain once a day in summer. Feeding once a day in summer is practiced largely as a matter of convenience and not because it is believed to be better for the cattle. For the most part the same reasons that make it desirable to feed grain twice a day in winter apply in summer with equal force.

NUMBER OF CATTLE TOGETHER

As to the number of cattle that should be run together in the same feed lot, it may be said that the common practice is to run them in droves of approximately 100, where large numbers are fed. There is no doubt, however, that except for convenience in caring for the cattle, smaller droves would be advisable. If the rule were made not to feed over fifty in a lot, it would be a good one, and then see that each lot of fifty is carefully assorted as to age, grade, and weight.

SALTING OF FATTENING CATTLE

There are those who claim that the salting of cattle is not only unnecessary, but positively detrimental to fattening cattle. Such claims are based upon evidence that is scarcely conclusive enough to warrant the abandonment of the use of salt in cattle feeding until the matter has received most careful confirmation by experimental demonstration. The writer believes, with the majority of cattle feeders, that salt is desirable and a helpful aid to appetite and digestion. It may be fed in small quantities at regular intervals, or provided in boxes to which the cattle have access at all times. We prefer the latter method, as it at once disposes of the question of the proper amount to feed. If the cattle can help themselves at will, and are never permitted to be without it, they will seldom take too much. We have used rock salt with satisfactory results, both for winter and summer feeding, but prefer the loose salt, especially for winter use, and advise placing the salt boxes under cover where at all possible.

A CONDITION POWDER

It frequently happens that an occasional steer or heifer gets out of condition and needs something in the nature of a tonic to tone up the system. The following has been found useful in such instances:

Mix thoroughly

4 lbs. sulphate of iron,
4 lbs. sulphur,
2 lbs. phosphate of lime,
2 lbs. pulverized anise.

Dose: One tablespoonful in a small bran mash twice daily.

DEHORNING STOCKERS AND FEEDERS—HOW AND WHY

The advantages of hornless stockers and feeders are obvious and are coming to be more and more recognized by breeders and feeders, as well as by buyers of cattle for slaughter. The advantages from the feeder's standpoint are economy of space in the feed lot and also in shipping, and possibly a higher price for the finished product.

Hornless cattle require much less room in the sheds and feed lots than those bearing horns, and there is no danger from goring each other with the horns. There is also a saving of room at the feed racks, as hornless cattle will crowd around a feed rack as close as they can stand, while those with horns require much more space, and even then there is danger of injury due to crowding for the feed. There is an economy when it comes to shipping, as more hornless cattle can be put into a car than can those bearing horns.

In a lot of feeders there are always a few timid ones, and these are driven around and kept away from the feed by the stronger ones, and, as a consequence, these animals make small gains. With hornless cattle much of this trouble is avoided.

Other things being equal, the buyer or butcher has

a preference for hornless cattle. Horned cattle always bruise each other more or less and when they are shipped long distances this bruising may be done to such an extent as to quite materially affect their selling price. Bruises on an animal usually show on the dressed carcass and detract somewhat from its value, and every puncture in the hide caused by a horn makes it less valuable for tanning. The shrinkage in weight during shipment is less with hornless than with horned cattle, as they are quieter. Hornless cattle are especially preferred for Eastern shipment and for export, but quite often even local butchers make a discrimination in their favor.

Since hornless cattle are more valuable to the buyer and butcher, they should command a higher price for the feeder. However, the difference in the price paid is usually not large. The claim is sometimes made that the presence of horns on an animal means a reduction of fifty cents per hundredweight in the market price, but this statement is overdrawn. A difference of ten to twenty-five cents per hundredweight is frequently made. This is especially true with cattle common in quality.

METHODS OF DEHORNING

The two methods of dehorning, usually practiced are, (1) the removal of the horns after they have reached their growth, by means of a saw or clippers, and (2) the prevention of the growth of the horn while the animal is yet young, by the application of a chemical.

In the early history of dehorning the instrument commonly used was a sharp saw, quite often a common hand saw. The animal was placed in a strong stanchion, a halter placed on the head and the nose drawn up. With the head of the animal in this position the horns could be quickly removed. The operation caused more or less excitement to the animal, and a great deal of pain. About 1890, clippers made especially for the purpose began to gradually replace the saw. By this

method the animal need not be secured except to be tied to a post with a strong halter. The clippers first used crushed the horn-core, leaving a wound that took a long time to heal, but with the modern clippers this crushing is largely done away with.

There is very little choice between the use of the saw and clippers in regard to the quality of the work done. The use of the saw requires a longer time and causes greater pain. By the use of the clippers the operation is done much more quickly and is all over with before the animal has a chance to struggle. When the clippers are used the blood vessels supplying the horn are cut off smoother than with the saw, consequently bleeding does not stop as quickly. Where either the saw or clippers are used it is necessary to get one-eighth to one-fourth of an inch below the point where the horn and skin grow together to prevent further growth. Unless this precaution is taken, the horn is likely to continue to grow, giving an unsightly appearance to the head.

The operation should not be performed either during fly time or cold weather, the best time being in the fall after the flies have gone and before cold weather sets in. When the horn is cut off the frontal sinus is opened, and during cold weather the air drawn in at each inspiration is likely to cause catarrh and give rise to serious trouble. If done in fly time the cavity frequently becomes fly-blown and filled with maggots, which prevents its healing and causes great agony to the animal. The operation should be performed on a pleasant day when the animals can be turned out after the work of dehorning is completed. It is well to have on hand some bandages, pine tar, and absorbents to check the flow of blood.

The easiest, cheapest, most successful, and least painful method of dehorning is by the application of a caustic while the animals are young. Although this causes some pain, it is merely a burning sensation which

does not last more than an hour at the outside, causes no nervous shock, and there is every reason to believe that it is much less than the pain caused by the use of the saw or clippers. By the use of this method there is no set-back to the animal, as the calves never miss a feed and there is no danger of the loss of a single animal. Another advantage of this method is that it leaves a much neater head than when the horns are taken off after they reach their growth, leaving the head resembling a natural poll rather than with a square top.

The substance used is caustic potash or caustic soda which comes in sticks about the size of a lead pencil, and can be procured at almost any drug store. When not in use the sticks should be kept in a closely stoppered bottle, as they will absorb water from the air and go into solution. It is claimed that this method is successful after the horn is an inch or more in length, but the best time to apply it is after the calf is about a week or two old, or just as soon as the button or young horn can be felt with the finger. The best method of application is to clip the hair from around the young horn with a pair of scissors, wet the stick of caustic potash (not with the tongue), and rub it vigorously on the skin over the horn. This requires but a few minutes and can be done by one man. A brown scab will form which will come off in about a month or six weeks, leaving a smooth, clean poll. To protect the hand, the stick of caustic should be wrapped with paper, leaving one end exposed. Do not get it too wet or it will run down over the side of the head, making a needless sore, and may get into the eye. In making the application, rub in thoroughly, as many failures have been caused by insufficient rubbing.

Since this method has come into general use, a number of patent dehorners have appeared on the market. These are nothing more than saturated solutions of caustic soda or potash and are sold at many times the price at which it can be purchased in sticks at the drug

store, and are no more and often not nearly so effective as the stick form. The cost of the stick form is so small as to render the cost almost inappreciable. Where large numbers of cattle are to be dehorned the cheapest method is undoubtedly the use of the clippers and they may be advantageously used at any time after the horn is well started. There are some dehorning clippers, too, especially designed for young calves. Dehorning while the animal is still young is to be encouraged.

CHAPTER XIII.

LENGTH OF THE FEEDING PERIOD

WHAT SHOULD BE THE LENGTH OF THE FEEDING PERIOD?

If this question were to be put to sheep and lamb feeders there would be but little difference of opinion. Experienced mutton producers look upon ten to fourteen weeks as about the proper length of time to feed. Horse feeders think one hundred days a desirable period for fattening heavy horses for market. The length of the cattle fattening period is extremely variable, ranging from ninety days to twelve months, and either of these periods or any time between these limits, may be considered good practice under certain conditions. If, for example, six to eight months old calves were purchased with a view of exhibiting at a fat stock show a year hence, it would be necessary to get the calves on full feed as quickly as it would be safe, and continue full feeding up to show time. In case of "warmed up" or fleshy feeders possessing considerable age they can be put in marketable form in from ninety to one hundred and twenty days.

FACTORS AFFECTING LENGTH OF FATTENING PERIOD

The principal factors affecting the length of the feeding period are, method of feeding, grade, condition, and age of feeding cattle used.

Method of Feeding: Where it is desired to feed a large proportion of roughage to grain to feeding cattle, the fattening process is slow. On the other hand the feeding of large proportions of grain to roughage, or, in other words, the feeding of a highly concentrated ration usually shortens the fattening period. Forced feeding

on highly concentrated rations required for quick finish is, of course, more hazardous than the longer feeding period with the more bulky ration. A compromise between the two somewhat radical methods has been practiced with excellent results. This compromise method is as follows: For winter fattening 1000-lb. feeders in a six-months' period, use thirty to sixty days for getting cattle to full grain ration, allowing free access to all the roughage the cattle will take at the beginning and gradually decreasing the amount of roughage as the grain is increased. With two and three-year-old cattle that are finished on grass, 120 days of full feeding are usually sufficient to put such cattle in satisfactory marketable condition after they have been carried sixty to ninety days on light grain rations.

Grade and condition of feeding cattle used: The quality or breeding of the cattle has a direct bearing upon the proper length of the fattening period. Common cattle of the lower grades and plainer sorts are not susceptible to the same high finish that can be given well-bred cattle, hence it is useless to feed them for it. Low grade feeders finish quicker than those of high grade at same weights and in same condition, because they are older.

Age of feeding cattle used: In ordinary practice it takes three to four months to finish mature feeders; five to seven months, two-year-olds; eight to ten months for yearlings, and ten to eighteen months for calves.

CHAPTER XIV.

FEEDING CATTLE FOR THE HOME MARKET

Feeding cattle for the home market might be compared in some ways with breeding horses with a view of producing horses which are best adapted for farm work. It is a relatively easy matter to satisfy the farm horse market as well as the local meat market requirements for fat cattle. It is not so easy to produce, at a profit, farm horses for the farmer's use or fat cattle for the local butcher. The main reason is that the horses classed as farm horses and the butcher cattle are abundant and not of the better grades, hence they are usually low-priced. The farmer does not believe that it is a business proposition for him to pay long prices for horses to be used by poor teamsters for farm work. The local butchers in small cities know that they can not charge for their cuts of meat what would be necessary to secure a profit if they were to buy the best grades of cattle.

The most popular cattle for the local butcher are fairly well fattened young heifers, weighing from 700 to 1000 pounds. These can be purchased cheaper than steers and make very satisfactory beef. The supply of such heifers is not sufficient to meet the demands of the class of trade that uses them, but this does not mean that the short supply will cause materially higher prices, as the local butcher has established a very narrow range of prices. If the supply of heifers becomes inadequate or their price too high he buys cows or plain steers.

The cattle feeder, therefore, who plans to feed cattle for the local market and make any profit must expect to handle heifers, young cows, and a low grade of steers. These must be purchased as feeders at low prices, fattened as economically as possible, and sold before they

reach a degree of fatness beyond that desired by the local dealer in fresh meats. That is to say, the local butcher who supplies the trade in small cities, and, for that matter, the bulk of the trade in large cities, cannot handle to advantage cattle that have been fattened to a high finish. Such cattle carry too much waste fat. Of course, no consumer, rich or poor, wishes to pay for waste fat. On the other hand but relatively few understand that the highest quality of beef is impossible without considerable quantities of waste fat. The wealthy consumer demands a choice grade of beef. To get it he is obliged to pay for some waste fat, which is sometimes delivered, but more often remains at the market.

Selling cattle to the local butcher is most often resorted to with a few odd cattle by large cattle feeders who wish to cull them before shipment, or by small cattle feeders who have but a few to sell. When we observe, however, that according to the best figures obtainable, nearly one-half the cattle slaughtered in the country are slaughtered by local butchers or at small markets, the importance of this branch of the industry is evident. (Garfield Report.)

CHAPTER XV.

KIND AND CARE OF PASTURES FOR BEEF PRODUCTION

There are two general systems in vogue for furnishing pasture for cattle — (a) permanent pastures and (b) pastures used in a rotation.

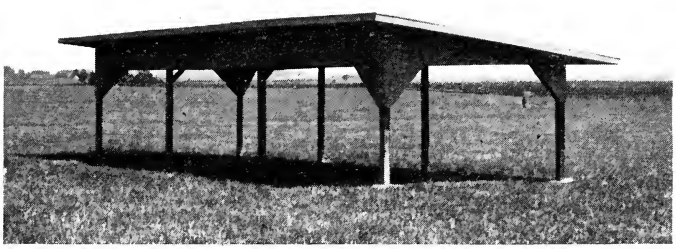
PERMANENT PASTURES

There are some decided advantages in using a system of permanent pastures for cattle. It simplifies the matter of fences, water supply, shade, and feed bunks. It does away with the expense of reseeding. Another advantage is that such a pasture properly managed is never a complete failure. It may be short on account of adverse climatic conditions, but it may always be relied upon to furnish some pasture. Again, the permanent pasture properly managed may be profitably used in prolonging the pasturing season. Undoubtedly these advantages have largely contributed in making bluegrass the favorite kind of pasture among cattle feeders in the corn-belt. Of the replies received in answer to questions sent out by the Illinois Experiment Station to a large number of cattle feeders, 55 per cent use bluegrass, 25 per cent timothy, 15 per cent clover, and 5 per cent some one or more of the following: Red-top, rye, cow-peas, and orchard grass.

PASTURE IN ROTATION

It is undoubtedly true that there are fewer bluegrass pastures in sections of the country where cattle feeding is a leading industry, than there were formerly, their place being taken either by a continuous crop-growing system or pasture in rotation. There are some ad-

vantages in this system. It gives a much better opportunity to evenly distribute on all parts of the farm the fertilizer produced by the cattle. Some have abandoned permanent bluegrass pastures, substituting in their stead pastures of mixed grasses in rotation, believing that by the latter method more grass is produced and the general interests of the farm better subserved. For example, in "Practical Farming and Gardening," David Rankin of Missouri, known everywhere among cattle-



A shed in the pasture for shade where there are no trees.

men, states unqualifiedly that he has abandoned the permanent bluegrass pastures for pastures of clover and timothy in rotation.

Whether a man should choose one system or the other will depend upon the location of the farm and whether or not portions of it are unsuited for growing crops and are well adapted for permanent pastures. Where on such locations a bluegrass sod can be secured and maintained perhaps no other excels it for general cattle feeding purposes. With proper attention such pastures improve with age. Timothy is not as rich in nutrients. The clovers and alfalfa pastures are admirably adapted to cattle feeding, except the tendency they possess for causing bloat, which must be carefully

guarded against. In case of alfalfa this factor is sufficiently important to render its general use for pasture questionable. No comprehensive experimental work has been conducted relative to the comparative values of different kinds of pastures for grazing or fattening cattle. In the absence of such data we can only say that from the cattle feeder's standpoint the best pasture for a particular locality and type of soil is that which will produce the largest average yield of beef per acre. The extent to which summer and winter feeding are practiced has a bearing on this subject as well as the kind of cattle handled and the labor available.

MANAGEMENT OF PASTURES

There is a number of considerations in connection with the care and management of pastures that should receive careful attention. Many pastures that are now supporting but one animal to two acres might be made to support twice the number with judicious management along the following lines: First be persistent in securing a good stand. The writer has traveled over many pastures that do not possess more than half a stand of grass, and it is obvious that such pastures cannot produce a maximum yield. Second, keep down noxious weeds. Weeds seldom exterminate themselves, but subsequently spread so rapidly that they take possession of the land to the exclusion of useful plants. Pastures should be gone over once or twice a year to remove weeds, and this should be done before they ripen their seeds. The drainage of pastures is frequently neglected because fields for pastures are usually selected on portions of the farm where the drainage is so imperfect that grain crops cannot be successfully grown. It should not be lost sight of, however, that not only the largest crops, but also the best and sweetest grass is grown on well-drained soil. Where land set aside for permanent pasture lacks fertility, a thorough top dressing of farm manure will show almost immediate returns. If the pasture

is to remain permanent for a series of years it will be profitable to add to the farmyard manure phosphorus in some form in which it will become slowly available. Bluegrass pastures of long standing or imperfect stand are greatly improved by thoroughly disking, after which some clover and timothy and possibly some bluegrass may be sown. A given acreage of pasture will furnish more feed if divided into medium-sized fields than it will if left in one large pasture.

One of the principal points to be observed in the management of pastures is not to overstock them. Cattle require luxuriant, not closely cropped, grass and if they are furnished with a continuous and abundant supply of the former they will make satisfactory gains at low cost.

FATTENING CATTLE ON GRASS

To advise what is good practice in fattening cattle on grass one must know whether or not the cattle feeder wishes to sell "grass fat" or corn fed cattle, at what time the cattle are to be marketed, and in what way they have been wintered.

To get satisfactory results from fattening cattle on grass alone the cattle used should be wintered very largely on roughage, for if they have acquired the habit of depending very largely upon a highly concentrated or grain ration for their nourishment they will shrink heavily when grain is withheld. If, however, cattle are to be fleshy enough to sell for killing purposes they must be in good, thrifty, and even fleshy condition. Cattle so conditioned for the market are seldom, if ever, fat enough to successfully compete in the market with corn-fed cattle, and unless land is cheap and corn high in price this practice seldom proves to be the most profitable one. Gains are undoubtedly cheaper than where corn or other concentrates are fed, but the lower price which must be accepted for such cattle usually more than counterbalances this advantage. That is to say

it is usually good practice to feed corn to cattle turned to grass when the cattle feeder anticipates selling them in the large markets for slaughtering purposes. Where pasturage is abundant on cheap lands within easy access of any of our large cattle markets a good rental may be secured on the land by purchasing thin cattle at the opening of the pasturing season and running them on pasture without grain as long as pasture remains good, or until a favorable market renders an earlier sale advisable. In a majority of instances such cattle are sold to local cattle feeders or returned to the market to be sold for reshipment to the country as stockers or feeders.

MANAGEMENT DEPENDS ON CONDITIONS

If an attempt is made to fatten cattle with grain on grass their management will depend upon their age, condition, quality, and the time of marketing them. If they are young cattle, either calves or yearlings, and it is intended to market them during the pasturing season or before it is necessary to remove them from the pasture to dry lot, they will need to be grained continuously from the time they are turned to grass until marketed. With older cattle well wintered the question of management is largely one of whether the cattle feeder plans to market during early, mid, or late summer. If early — that is, by June 15 — the writer is strongly of the opinion that the cattle would better never be turned to grass, but finished in the dry lot. Such cattle are usually so far advanced in flesh at the season for turning to grass that if they are turned to grass the shrinkage is too great to make the method practicable. If the cattle are to be marketed about the middle of July it is then necessary to have the cattle on full feed when they are turned to grass and continue the same until marketed. By marketing by July 15 the hottest weather of summer is avoided, which is usually attended with myriads of pestiferous flies, which are extremely annoying to cattle and which materially

lessen the gains during this period. In changing from dry lot to pasture there are some questions arising that should receive attention. For example, "Is it better practice to turn fattening cattle to grass early or late in the spring?" The answer to this will depend upon the character of the grass and condition of the cattle. If there is a good quantity of old bluegrass left from the preceding season it is good practice to turn cattle to grass early, whereas, if all the grass is a fresh growth, severe scouring will likely follow such practice. Where pastures are eaten close the preceding fall, the grass should be allowed to get a good stand and get some substance before the cattle are turned on them.

HOW TO TURN ON GRASS

If at all practicable, it is wise to turn cattle to grass for only an hour the first day during the middle of the day after the cattle have filled on their regular feed. On the following day the cattle can be left on grass for a longer time and on each succeeding day until they are allowed to spend their entire time on the fields. This method occasions considerable trouble and is unnecessary unless the cattle are quite fleshy. By many it is believed, and this belief is shared by the writer, that rather more pasturage for the season is secured by letting the grass get a good start in the spring.

Corn may be nearly all, or in some instances all, the concentrate used. This will depend upon the age of the cattle, the kind of pasture, and how soon it is desired to finish the cattle. The younger the cattle, the more advisable is it to feed some concentrate rich in protein as a supplement to corn. Both oil meal and cottonseed meal are extensively used for this purpose. If it is desirable to finish older cattle in the shortest possible time, those feeds may be fed to advantage. If the pasture is made up quite largely of clover or alfalfa there is less need of these feeds than where cattle are run on bluegrass. The prevailing impression among cattle feeders

is that the practice of turning cattle to market before the hottest months to avoid heat and flies is increasing. Corn may be fed in the form of broken ear corn, shelled, corn and cob meal, or cornmeal. Where shelled corn is fed it has been found good practice to soak it for twelve hours before feeding, great care being exercised to prevent souring either before or after being placed before the steers. In whatever form the corn is fed, hogs should be provided to follow the steers. More hogs may be used to advantage behind steers fattening in summer on grain and grass than in winter in the dry lot, first because the hogs get a portion of their feed from the grass, and, second, the hogs are not required to wade about in mud to pick over the droppings.

START ON NEW CORN IN SEPTEMBER

If the cattle feeder wishes to carry the cattle through the summer without grain, fattening them off on the new corn, it will be advisable to start with the new corn some time in September, depending upon the location and season and increasing very gradually until the cattle are getting all they will eat. Thirty days is the minimum of time for getting cattle on feed in this way. If the grass is good the cattle will soon begin to leave more of the stalk than should be wasted. In this event only such amounts of the shock corn should be fed as will be economically eaten by the cattle, substituting snapped corn for a part of the shock corn. Grass fat cattle handled in this manner for ninety days will be in good marketable finish, especially if the corn is supplemented with oil meal or cottonseed meal.

CHAPTER XVI.

HOGS IN THE FEED LOT

The hog is reckoned by cattle feeders as a most important factor in cattle feeding operations and his definite relation to this industry is a matter of much importance. The facts and suggestions used in this discussion are based upon accurate data gathered by experiment and inquiry by the Illinois Experiment Station. The subject may be well divided as follows:

1. Kind of hog best suited for following cattle in feed lot and pasture.
2. Method of determining the best number to use.
3. What may be done to increase the efficiency of the pig?
4. Results which may reasonably be expected.

First, as to the kind of hog best suited for following cattle in the feed lot and pasture. It is seldom good practice to use pigs under six months of age because of the danger of injury in running about among the cattle, and further, the feed which they get from the droppings is not calculated to produce growth on the pigs. Brood sows are sometimes used to follow cattle. This practice may be followed with good results when fattening cattle are on grass, especially if the pasture furnishes clover or alfalfa pasturage for hogs as well as for cattle. But allowing brood sows to follow fattening cattle which are rather closely yarded in winter, and especially where no separate shelter is provided for the sows, is a practice to be discouraged. The kind of hogs that have proved to be best for following cattle are young thrifty shoats weighing about one hundred pounds each. These should be in thinnish flesh and of an active, strong boned type or breed.

Second, as to method of determining the best number to use. This is, perhaps, the most important factor in connection with the problem and yet one that has hitherto received but little consideration. The first point to consider is whether or not other feed than that in the droppings is to be given the hogs. If so, this largely simplifies the question. Judging from a large number of inquiries on this subject at least eighty per cent of the cattle feeders give hogs following fattening cattle feed in addition to that secured from the droppings of the steers. It is thought that this practice is common because it does away with the necessity of closely watching the pigs and droppings to see that just enough and not too many hogs are provided and the number of hogs which the cattle feeder wishes to fatten is in excess of what would be required to consume the undigested portions of the feed given the steers. This being the case it is usually much more convenient to run all the fattening hogs about the farm with the fattening cattle. The fact that the fattening of hogs has been more generally followed with profit than the fattening of cattle has also had its influence upon the somewhat general adoption of this method. The writer is not familiar with any experimental data upon the subject as to whether or not greater returns are secured from the droppings alone where pigs are restricted to them or where fed additional feed. At the Illinois Experiment Station an effort has been made in each of the extensive cattle feeding experiments to determine the relation of the hog following the steer to the general proposition of cattle feeding. In each instance the number of hogs following the steers was regulated in such a way that they would thrive on the droppings alone. Some of the more important facts brought out in these experiments are that there is very little hog feed in the droppings of steers fed silage. Silage is usually supplemented with corn in some other form and in such instances the approximate amount of available

hog feed in the droppings should be determined upon the basis of this supplementary corn fed and the form in which it is fed, exclusive of that contained in the silage. Some cattle feeders feed rather more corn to cattle than they will clean up, throwing out the rejected portions to the hogs. This method increases the number of hogs that may profitably be run after cattle, but in the experiments referred to the hogs following the cattle did not have this advantage. In one experiment ten shoats were found to be about the right number to follow twenty-five steer calves fed on a light "wintering ration" of shock corn, whole oats, and clover hay. These shoats made a gain of 587 pounds in 88 days. During the same season in another winter feeding experiment where thirty-six two-year-olds and older steers were being fattened for the market, during the time shelled corn was fed, twenty-one hogs followed, and, when changed to meal twelve hogs only were used. These steers were fed in three lots, each lot getting a different ration. The hogs following the twelve steers fed corn and clover hay made 3.78 pounds per 100 pounds of shelled corn fed and .616 of a pound per 100 pounds ground corn when they were changed to a meal ration. The hogs in the lot getting corn, corn stover, and timothy hay made 3.665 pounds gain per 100 pounds shelled corn fed the steers, while they made only .594 of a pound gain per 100 pounds ground corn fed. The data illustrate two important facts; first, that the gains on hogs following meal-fed steers are inconsiderable as compared with similar gains where the steers are getting whole corn, and second, that a nitrogenous roughage fed to the steers seems to favor, if only to a slight degree, large gains on hogs following steers so fed.

The following table furnishes some valuable data which were secured from records kept on the feeding of 130 steers at the Illinois Experiment Station in ten different lots:

Lot No.	Form in which corn was fed	Pigs per steer	Pounds pork per steer	Pork made per cwt. of corn fed steers, pounds	Per cent of feed given steers paid for by hogs following, hogs valued at $5 per cwt.
1	Silage and cornmeal	0.10	6.30	.19*	.94
2	Ear corn	0.53	62.60	1.68	9.70
3	Ear corn (without nitrogenous concentrates)	0.53	74.13	1.89	14.05
4	Corn meal	0.27	20.66	.67	3.00
5	Corn meal (hay chaffed)	0.27	20.02	.65	2.86
6	Corn and cob meal	0.27	18.00	.46	2.60
7	Corn and cob meal (hay chaffed)	0.27	24.00	.63	3.34
8	Shock corn and ear corn	0.60	73.50	1.81	12.72
9	Shelled corn (mud lot)	0.70	85.80	2.79	12.86
10	Shelled corn	0.70	111.50	3.61	16.67

*Computed on basis of ear corn in silage and shock corn.

This valuable table throws much light, not only on the question of the factors determining the number of hogs to use, but upon the other questions in the analysis of our subject, viz.: (3) "What may be done to increase the efficiency of the pig?" and (4) "Results which may reasonably be expected."

CHAPTER XVII.

FITTING STEERS FOR EXHIBITION

The selection of animals to be fitted for exhibition purposes is obviously the first essential. It goes without saying that they should be the best individuals in the herd. Animals that will respond properly to fitting and develop into smooth, thick fleshed beasts should be selected. The head should be broad between the eyes, short from eye to nose, nostrils and mouth large, indicating great feed consuming capacity, eyes bright, yet placid, indicating a quiet disposition, legs short, body broad and deep, back and underline straight, tailhead broad and smooth with the tail well set on. Style and quality are essential points. Quality is to be looked for especially in the hair and bone.

Care should be taken to select animals having all the advantage of age that is possible. For senior calf and yearling classes, animals dropped in September and October should be selected, while for junior classes, January and February born. For calf classes the selection is usually made when the calves are from three weeks to a month old, as the ones nearest perfect at that time are usually the ones that will make the best finished animals. In selecting the calf, breeding should not be overlooked, for as are the sire and dam, so, to a greater or less extent, will be their offspring.

After the selection has been made, the next important thing will be the feeding and management during the growing period. Success in this will depend largely upon three things: the comfort of the animals, a variety of good feeds, and the skill of the feeder.

The calf should be allowed to nurse the dam as long as possible, as there is no other feed that will keep a

calf growing like the mother's milk. In pleasant weather they should run out on pasture where they can get plenty of fresh air and sunshine, but care should be taken that they do not get too much exposure during storms. They should not be permitted to lie down in cold, damp places where they are apt to catch cold. When the winter comes on, the calves should be housed in roomy pens with plenty of air and sunshine, and provided with a dry bed. During good weather they should be allowed the run of a sheltered lot provided with good water. At the age of from six to eight weeks they should be gradually started on a grain ration consisting of equal parts of shelled corn, whole oats, and bran, with all the clean clover or alfalfa hay they will clean up.

At an early age the calves should be familiarized with grooming. This not only keeps the coat in a better condition, but also gets the animals used to handling, which will save a great deal of time and trouble later on.

In the spring the calves should be put on grass, at first only for an hour or so during the middle of the day, and later on should be turned into the grass lot at night. This change to grass may be a period of little gain, but the grass cools their system and prepares them for the heavy feeding which is to follow. During the hot summer months they should be allowed to run in the pasture at night, but through the heat of the day they should be protected from the heat and flies by being kept in a cool, well ventilated stable. Some feeders further protect them from flies by keeping them blanketed, and by darkening the stables as much as possible without interfering with ventilation.

When the animal is to be shown in the fall, there is a difference of opinion as to how soon it should be taken off the pasture, but it should certainly be taken in before the middle of the summer. This period between the time of removing from pasture until the time of the show, and especially during the last six weeks, is a time

in which especial care should be taken, and one which calls for all the skill the feeder possesses. During this time it is necessary to put on the proper amount and quality of flesh, and the finish and bloom necessary to make a prize-winner.

Probably the most important consideration during this latter period of preparation is the feeding. Some succulent food for its laxative and appetizing effect should be given, but care should be taken not to give so much of such feeds as to detract from the consistency of the flesh. Roots or corn silage serve well for this purpose. The grain ration should consist of ground oats, corn, and bran, with a little oil meal, but an excess of corn should be avoided, as smoothness of finish rather than excess of tallow is desired. For roughage, a good quality of bright clover or alfalfa hay should be fed. A variety of feeds is very desirable and everything should be done to tempt the appetite, but sudden or violent changes are very disastrous. If an animal shows a tendency to be paunchy, limit the amount of roughage given. An important consideration in feeding cattle for show is regularity. The custom is to feed three or four times a day and water about twice, and this should be done at the same time of day, as the cattle soon become able to know when feed time comes and will be up and looking for their feed with very great precision. They should be fed in loose feed boxes that can be taken out, thoroughly cleaned, and occasionally scalded. In order to restore a jaded appetite, the novice is frequently tempted to resort to a tonic, such as iron or some patent stock food which he sees so widely advertised; and although these things may have their place, this place certainly is not in the hands of an experienced feeder in fitting cattle for the show ring. The proper handling of a steer with a dull appetite is to withhold all feeds for a time and then give him a fill of grass. It is better to avoid a poor appetite by careful feeding than to attempt to cure it by means of some nostrum.

During the latter part of the feeding period, progress depends on nothing more than on content. The animal that eats its fill of any suitable ration that suits the palate and then lies down in peace and quiet to ruminate will make good gains. Rumination is best performed when, for the time being, all the animal's energy is given to this one thing, and hence is best performed while lying down.

When stabled, the animals should be well bedded with fresh, bright straw. The animals should be led from the stall twice daily and all droppings and wet straw removed and fresh straw put in. Attention should also be paid to ventilation. An abundance of fresh air should be provided, but the barn kept free from draughts. When the barn is well provided with windows it is a good plan to remove them and cover the openings with burlap. For fattening purposes, a darkened stable is preferred to one with too much light.

As the show approaches they should be trained to stand squarely on their feet, with heads up, so as to appear to the best advantage.

A good coat of hair should, if possible, be secured. It has been said that this depends not so much upon what is put on the hair as what is put inside the animal, aided somewhat by what is kept off the hair. Grooming should be commenced some weeks before the show, and for this purpose nothing should be used but a good bristle brush, aided by a flannel cloth or chamois skin. The steel curry combs and steel brushes are not in favor. A good use for the curry comb is to comb out the bristle brush. Some feeders prefer to keep the animals blanketed for six months before the show, never letting the coats see the light of day. This, however, is not thought necessary or even advisable by most feeders. If the animals are kept in a darkened stable, blankets are unnecessary except during the last few days. The coat can be greatly improved by a weekly washing with soft water and a good toilet soap, but never use hard water,

laundry soap, or washing powders. Some recommend giving the animals a daily wetting with soft water and a spray pump. The one great thing that is liable to play havoc with a coat of hair is founder, and especially grain founder. It cannot be detected until after the harm is done and naked spots appear all over the animal. Cattle just going onto full feed are especially liable to this.

In fitting the horns, thoroughly remove the dead outer coat or covering. First use a sharp, heavy rasp, and finish up with a jackknife and finally with emery paper. Cover the horns with sweet-oil and allow a few hours to dry in, then smear them with paste made of sweet-oil and tripoli. Polish thoroughly with a wide strap or woolen bandage, and repolish with a strip of chamois skin and any good polishing powder. The strap should be wound once around the horn and the powder dusted under it, and friction enough obtained to melt the surface of the horn.

Attention should be given to the hoofs. Where a steer is kept in a deeply bedded stall, the hoof is not subjected to friction and grows out long and unshapely, and as there is no moisture present the walls become dry and contract and the feet become feverish. The former defect can be remedied by trimming the hoofs back at frequent intervals, and the latter by making a clay puddle through which the animal should be led several times each day.

With a considerable number of cattle to ship, a large furniture or vehicle car will be found best suited to the exhibitor's needs; with a smaller number to ship, an ordinary box-car with small doors in the end will be found very satisfactory. The sides of the car may be padded with burlap to prevent bruising. In loading the cattle they should always be tied to the side of the car and shipped "side to." It is not desirable to have them ride "end to" as they will be thrown forward

against their horns or backwards so as to pull on the halter rope.

An animal should not be tied by the nose ring. Neck ropes would better be too light than too heavy, as it is better to have the rope than the animal's neck broken from an excessive jerk. Put enough straw under the animal to insure an easy ride; this should be about eighteen inches. Send along enough helpers to properly care for the cattle.

Securing "bloom" or just that desirable condition or stage of fatness that is most acceptable to the judge is, perhaps, the finest point of the art of fitting cattle for show, and the ability to bring out animals in a little better condition than others are able to do, is what characterizes some herdsmen as peculiarly skillful. There is, practically speaking, no danger of getting the calf or yearling too fat or "overdone," while with the two-year-old, such a condition is not uncommon. By following the suggestions given above, however, this danger will be reduced to the minimum. While the calf or yearling is seldom too fat to show as a calf or yearling, they may be made too fat to carry on successfully with a view of making them acceptable show animals a year later.

CHAPTER XVIII.

ADVANTAGEOUS SEASONS FOR MARKETING VARIOUS GRADES OF CATTLE

No attempt will be made to enlighten the cattle feeder as to when he may look for a good market or a "slump." The writer recognizes the fact that the best time to market cattle is when the highest market price may be secured, but the practical finisher of cattle understands that one cannot engage in the cattle feeding business and expect to strike the good market every time his stock is ready for the market. There are some general considerations, however, which should be fully understood. The knowledge of these facts and the formulation of cattle feeding practice accordingly will save the novice a large amount of needless loss.

DEMAND FOR PRIME CATTLE

There is usually a good demand every month in the year for both light and heavy weight, strictly prime cattle, for the high-class beef trade of the country; that is, such as is used by the wealthier families and high-grade hotels, and restaurants. Because of its use there is not an unlimited demand for such beef, and, if prime cattle, from which this grade of beef is cut, are offered in excess of requirements, prices seek a lower level. Prices for such cattle on the hoof are regulated from month to month, according to the supply. During the Christmas season such cattle are required in large numbers as has been said in Chapter XI.: "From November 23 to December 15 buyers for local slaughter, shipment, and export are on the market until their orders are filled. Exporters who buy for the foreign holiday trade usually buy most of their cattle from November 25 to 27,

although these dates may vary a little one way or the other, depending upon the days the export boats sail for foreign ports. Ordinarily, exporters take from one-fourth to one-third of the total supply of Christmas cattle for both dead and live export. The larger proportion of holiday beef is exported alive, and for this purpose cattle possessing fancy quality and thick fat, weighing from 1300 to 1500 pounds are wanted. From 1300 to 1400 pounds is a popular weight, although they use some prime 1100 to 1200-lb. cattle for that trade and a few weighing as much as 1600 pounds. For the New York and Eastern holiday trade, the first ten days of December, particularly from the 5th to the 8th, is considered a good time to market. For the Chicago city trade and nearby cities and towns, from December 10 to 15; New York, Boston, and some other Eastern cities use more heavy or good weight cattle than the Western cities. They also use a good proportion of yearlings, and light weights, and the light and medium weight prime cattle seem to be getting more popular each year."

DEMAND FOR BABY BEEF

Outside of the Christmas market, during which there is the demand for baby beeves indicated, there is not much preference as to the most favorable season for marketing such cattle. There is a good demand the year around and prices depend upon the supply from month to month. If there is any preference it would be during the hot weather months. From 800 to 1000 pounds is a popular weight for yearlings and 1100 to 1300 pounds for two-year-olds. Some buyers prefer a weight of from 1000 to 1100 pounds, and then again there is a good demand for 600 to 800-lb. steers and heifers. There are not as many two-year-olds as yearlings used. There is no discrimination against 600 to 700-lb. baby beeves, if prime. *It cannot be too strongly emphasized, however, that baby beef to sell high*

must be prime in quality and finish. Hundreds of young cattle are annually shipped to the market that bring prices which disappoint the feeder, and most frequently because he has not made them fat enough. Taking the year around the prices for baby beeves of quality and finish will average well with those of older and heavier cattle of same quality and condition.

DEMAND FOR EXPORT CATTLE OTHER THAN AT CHRISTMAS

The most profitable time generally for feeders to market export cattle at the Western markets (barring Christmas time for that grade of export cattle) is winter, spring, and early summer months. The reasons are that during the late summer and fall months Canada usually markets a good many grass cattle; also they use more or less of the Northwest range cattle for export trade, both dead and alive. Of course, the extent of this latter depends upon the condition or fat of the range cattle. As to the activity of the demand during the different months or seasons of the year, that depends to a considerable extent upon the foreign market and their supply of cattle. Some years Canada has a heavy supply of exports; then again it is moderate. The dressed beef trade of the Argentine is increasing materially, and this is all having its effect upon the demand for export cattle from this country.

DEMAND FOR COMMON CATTLE

Such cattle are usually best marketed from March 1 to June 1. They could not, however, be said to be "out of season" any time from January 1 to July 1. After July 1 they come in competition with the cheap Western range cattle.

CHAPTER XIX.

MARKETABLE CONDITION. PREPARING CATTLE FOR SHIPMENT

WHEN IS A STEER READY FOR MARKET?

If this question were put to the buyers of any of the packing companies they would instinctively answer, "When fat, or in a condition popularly spoken of as finished." Their answer to the question would be entirely from their standpoint and not from the standpoint of the cattle feeder. It is undoubtedly true that one of the commonest faults among market cattle is lack of condition, and this fault is most common with cattle fed by beginners. However, even experienced cattle feeders frequently ship cattle to market that, to fully ripen, would require full feeding for sixty, and, in some instances, as many as ninety days. Clearly, therefore, experienced cattle feeders must believe that they get larger net returns by so handling cattle, or they would have long ago discontinued the practice. The writer appreciates the fact that it takes the highest finish to bring top prices, but at the same time it must be borne in mind that a steer must be something more than fat or ripe to sell as prime.

If experienced cattle feeders were asked to express an opinion as to when a steer is ready for market, they would almost universally agree that he is ready for market, or, at any rate, should be shipped to market at a time when he will net the feeder the greatest profit. This is an extremely difficult matter to figure out, for the condition of fat cattle that will net the feeder the largest profit may not be, and often is not, the condition that will bring the top price for any given grade or quality of cattle. Another factor that plays an im-

portant part is the general supply and demand of the market at a given time. A degree of condition that might yield the largest profit at one time with a strong and high market might not be the condition for greatest profit when the cattle market is weak and low. This whole question cannot be intelligently answered without an intimate knowledge of at least the following factors:

1. Age of cattle.
2. Quality or breeding of cattle.
3. Condition of market.
4. The relative cost of putting cattle in prime condition as compared with the cost of merely warming them up and also of the so-called half-fat condition.

These points are not capable of other than the most general treatment.

As regards age, it may be said that it is extremely difficult to get a steer under two years of age too fat to suit the trade, and within certain reasonable limits such a young steer, if well bred, may usually be put in prime condition profitably, providing market prices and cost of feeds and feeders are such that there is profit in handling that kind of cattle at all. With the three or four-year-old steer the situation is entirely changed. The process of feeding a steer of such an age, until he is prime in condition is an expensive job and will not usually pay unless such animal is well bred. This suggests that as a general proposition, cattle of the commoner grades (speaking now only of their quality or breeding) do not require or acquire as high a finish as the better bred ones. The degree of finish which should be aimed at in any particular instance will depend upon the condition of the market and the cost of feeds. Obviously when feed is high and fat cattle are low, the securing of high finish is usually attended with loss, whereas if both feed and cattle are low there might be a possibility of profit following the securing of high finish. If cattle are high and feed high, providing feeders have been purchased at a reasonable price and the quality is good, it usually

pays to feed until choice to prime condition is secured. A more intimate and accurate knowledge of most of these factors is in the possession of progressive live stock commission companies, and the cattle feeder who does not keep in close touch with such is not likely to form as wise conclusions without their help, although the cattle feeder must needs do some hard thinking for himself.

In conclusion, we do not wish it inferred that the writer leans to the opinion that it generally pays best to stop short of prime condition. We have inferred that at times it does and at other times it does not. In case prime condition seems desirable, the following suggestions as to how to judge it may be helpful:

Fullness at base of tongue, fullness or a roll of fat in front of point of shoulder, a full twist; a large, mellow cod; a low, full, thick flank that stands out and rolls visibly as the animal walks; fullness and smoothness at rump and tail-head indicate that degree of fatness which is essential to the highest quality in beef. These points, which are to be judged by sight rather than by touch, are the ones most depended upon by buyers at the yards.

Figure 13 illustrates a steer in a half-fat and prime condition

PREPARING CATTLE FOR SHIPMENT

There are shippers who, by divers practices, have secured an abnormal fill at the market, or, in other words, have been successful in making their cattle weigh more than they should by inducing them to drink an unusual amount of water when they reach the market. It should not be forgotten that there are past masters of the "filling" process at all our leading markets, and many of them operate outside the fat cattle division, too. The trained eye of the buyer of fat cattle is always on the lookout for cattle that have filled unusually well, and when he sets the price on such he is sure to discriminate against them in value per hundredweight, as he knows

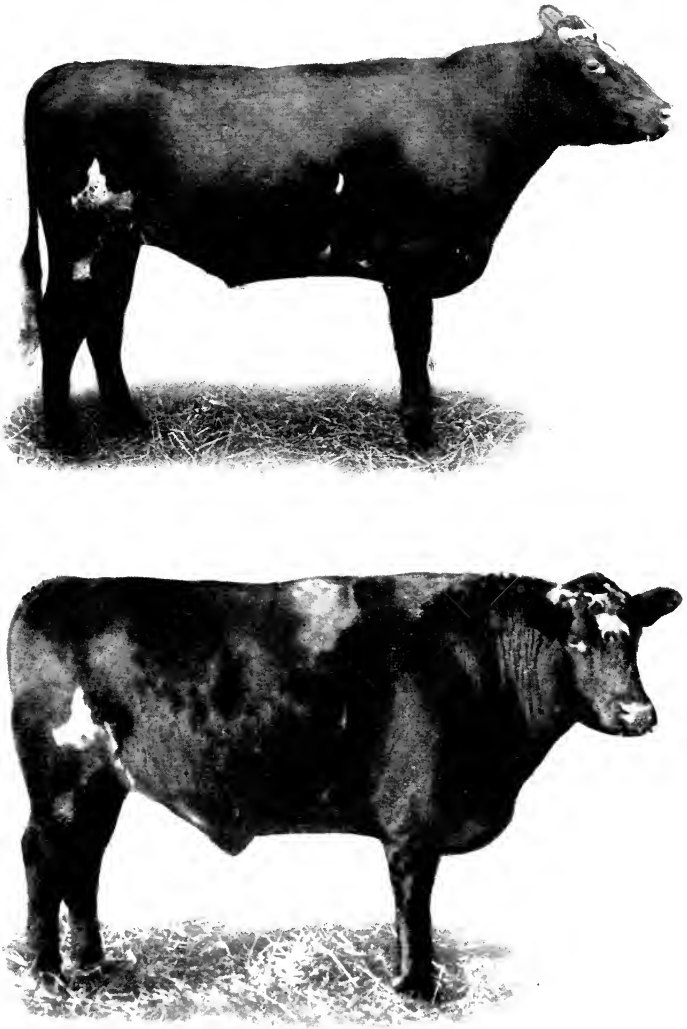


Fig. 13. The same steer in a half-fat and prime condition.

there will be a heavy shrinkage when slaughtered. Any practice which tends toward securing an abnormal fill on cattle at the yards is neither a legitimate practice nor is it likely, in the long run, to prove a paying proposition from the standpoint of the shipper. On the other hand, it is a well-known fact that unless some precautions are taken before shipment, the cattle are apt to scour and shrink abnormally. The shipper is justified therefore, in using legitimate methods of preventing scours, not only to avoid an abnormal shrinkage, but also to prevent the cattle arriving at the market in a filthy condition, which, from the standpoint of the buyer, would not add to their attractiveness.

MANAGEMENT IS LARGEST FACTOR

It may have been inferred from what has been said that the principal point to be observed in shipping cattle without too much shrinkage is following some peculiar method of feeding, but the writer believes that the largest factor is the management of the cattle — that is, they should be so quietly handled that they do not become excited or heated. If possible, driving should be done in the cool of the morning or evening. There are some feeds, which, if the cattle have access to them prior to shipment, will be more likely to cause scours than others. These are shelled corn, cornmeal, oil meal, silage, clover hay, alfalfa, cow-pea hay, and grass. Cattle that are fattened on grass and grain during the early part of the season may well be yarded for a day or two before shipment and fed timothy hay and a considerably reduced grain ration.

Fat cattle shipped from the dry lot, if receiving clover or alfalfa for roughage, should be changed to timothy hay at least twenty-four hours before shipment. No full grain ration should be given after twelve hours before shipment, although it is advisable at times, and especially if the cattle have been fattened on shelled corn or meal, to add a liberal amount of oats or bran to the

feed. Water should be withheld for six hours before shipment.

BED CAR WELL AND DO NOT OVERLOAD

If, in addition to the above precautions, care is taken to bed the car well and not overload, the cattle should arrive on the market fresh and clean and will fill normally, which, it is unnecessary to say, should be the object of the shipper. Cattle so shipped should make honest weights for the producer and buyer and healthy meat for the consumer.

It is obvious that the management of cattle before shipment will necessarily vary considerably not only because of differences in their condition, and the rations upon which they have been fed, but also the distance from market and the time they will be on the road, and whether it is necessary to unload and feed enroute. Some of the suggestions offered will apply only to the preparation of cattle for shipment where they are not to be on the road to exceed twelve hours.

CHAPTER XX.

LICE, MANGE, RINGWORM, LUMP-JAW, BLACKLEG, AND TEXAS FEVER[1]

Cattle Mange (Texas Itch, Cattle Scab, or Range Itch) is a skin disease affecting cattle only, and is caused by a minute animal parasite *Psoroptes communes* very closely related to the mite that causes scab in sheep. It is not known that the sheep mite ever infest cattle, nor will the cattle mite injure sheep. The mite is very small, barely visible to the naked eye. It can very readily be detected by scraping the surface of the skin with a sharp instrument and allow the substance scraped off to remain five to ten hours in a clean, wide-mouthed bottle. White specks will appear on the surface of the glass, which, on examination with a lens, show the details of the parasite.

Cattle mange appears to be more troublesome during the late fall and winter than at any other time of the year, and usually disappears in the spring when the cattle are turned out on pasture. Cattle of all ages may become affected, but it seems to be more pronounced in yearlings and bulls; on bulls perhaps, because they come in contact with more animals and are more liable to become infected.

The first symptoms noticed are intense itching of the skin, usually in the region of the neck and shoulders, and shedding of the hair on the neck and withers. In aggravated cases the irritation may extend all over the body, but the most prominent points where the disease

[1] The information here presented on Lice and Mange is taken from Bulletin of the Agricultural Experiment Station of Nebraska, vol. XIV., Article IV.; on Ringworm from Report of Bureau of Animal Industry, Diseases of Cattle.

first appears are the base of the tail, the neck, withers, and shoulders. The skin becomes thickened and very dry in places, the hair dropping off, leaving large bald patches of thickened and callous skin. As the disease progresses, there is an intense itching, and the animal will be seen rubbing itself against fences, posts, buildings, etc., sometimes causing large bleeding scratches and sores. Animals in the advanced stages of the disease eat very little, and spend the most of their time in rubbing. The disease spreads very rapidly throughout a herd, and appears in from four to six weeks after exposure. It spreads by direct contact of diseased with healthy animals, and railroad cars, stock-yards, mangers, sheds, posts, chutes, and fences may also be sources of infection.

The method of treatment advised is the application by spraying or dipping, using a liquid that will kill the parasites. In small herds the liquid may be applied by means of a swab, brush, or spray pump, but even on a small scale it is expensive and impracticable, and is very likely not to be thoroughly done, as it is hard to get the liquid into all the wrinkles and folds by this method. The best plan is to dip in a properly constructed dipping vat, and this method is coming to be the one most used especially in the great grazing sections, where coöperative dipping plants are operated.

There are numerous dips on the market, and no doubt they all have their merits, but the ones found to be most effective are the coal tar preparations, such as Chloro-naphtholeum and Zenoleum. These should be used in a 3½ or 4 per cent solution, the latter being preferred. In mixing the dips, soft water should be used, and if this cannot be obtained, add to the hard water sufficient washing powder or soda to soften it, otherwise the preparations will not thoroughly mix with the water.

Great care should be taken to make the dipping thorough. A simple plunge in and out is not sufficient; the cattle should be immersed from one to three minutes.

Previous to the dipping, the scales should be loosened up with a brush or broom to allow the mixture to thoroughly penetrate the diseased areas. See that the head and all parts of the body are immersed. After cattle are dipped they should not be allowed to go back to infested pastures or stables, or be allowed to mix with infected cattle, as they would thus become reinfected and all the benefits of the dipping would be lost.

In order to make the operation a success, the dipping should be repeated within ten days to kill the parasites that have hatched out since the last dipping, before they have time to lay their eggs.

Pregnant cows and heifers should not be dipped after they are more than three or four months advanced, and even previous to that time care should be taken to avoid crowding in the chutes.

It is best to dip twice in the fall and twice in the spring, at intervals of ten days. The dipping usually costs from five to eight cents per head.

LICE

The two most common kinds of lice found on cattle are the long-nosed ox louse and the short-nosed ox louse. The methods of eradication are the same as for mange.

RINGWORM

There are two kinds of ringworm, *Tinea tonsuraus* and *Tinea favosa*. *Tinea tonsuraus* is caused by a minute fungus which affects the hair and the epidermic layer of the skin. It forms circular patches on the body where the hair falls off and the skin becomes slightly inflamed, followed by the formation of scaly, brittle crusts. After the patches become incrusted they have a silvery gray appearance, and are confined mostly to the head and neck. It is a very common disease among young cattle in the winter and spring. It is highly contagious, being readily transmitted from one animal

to another, and is communicable to man. The disease is attended with more or less itching.

Tinea favosa is caused by another fungus which affects the hair follicle and the cuticle surrounding it. Small crusts form which increase in size and thickness and then become elevated at their margin, forming a cup-shaped scab, which gives the disease its distinctive character. The crusts are of a pale sulphur-yellow color at first and grow darker with age. The disease has a peculiar odor, resembling that of mice or musty straw. It may be communicated to cattle by man, mice, cats, etc., all of which are subject to the disease.

The treatment of either form of the disease is to remove all crusts by washing with soap and water, then apply acetic acid, sulphur ointment, tincture of iodine, or nitrate of mercury ointment, once a day. Disinfect the stables and whitewash them to destroy the spores scattered by the crusts.

LUMP-JAW (ACTINOMYCOSIS)[1]

This disease is caused by a vegetable organism, supposed to be a fungus, known as actinomyces. The fungus is composed of minute, radiating, club-shaped particles, hence it is known as "ray fungus." The parts of the animal commonly affected are the bones of the upper and lower jaws, and the soft tissue between the two branches of the lower jaw, although it sometimes affects the lungs and other internal organs. The disease is characterized by peculiar enlargements around the head, or other parts affected. These enlargements develop in time from the size of a hen's egg up to that of a man's head.

The natural habitat of the fungus causing the disease is supposed to be on forage grown on low, wet ground, and especially on the awns of barley. As the animal masticates such forage, abrasions of the soft tissues of the

[1] The information here presented is taken mainly from Reynolds' Veterinary Studies.

mouth are made, which serve as channels of entrance for the fungus. It may also be introduced in other ways, as decayed teeth or the shedding of milk teeth.

Although the matter has received quite a good deal of attention, not much has been done in the way of prevention. The disease does not spread directly from one animal to another, but when the tumors reach their growth they break open on the outside and discharge a yellowish substance which is full of the ray fungi. An animal with such a discharging abscess would, of course, infect food in mangers, feed troughs, and grass in the pasture and thus offer an excellent opportunity for infection of other animals. Animals with discharging abscesses should be killed or confined away from other animals. Pastures in which cases of lump-jaw seem to develop rather commonly should be placed under cultivation.

The two most common methods of cure are (1) to cut out the tumor, and (2) the iodide of potassium treatment. The cutting method is very effective in the early stages of development, but should be undertaken only by a trained veterinarian on account of the proximity to large blood vessels. Dr. M. H. Reynolds, B. S. A., D. V. M., M. D., professor of veterinary medicine, University of Minnesota, outlines the potassium iodide method as follows:

Give by means of the mouth, either as a drench or dissolved in the drinking water. The daily dose is about one-fourth dram per hundred pounds live weight. "This dose is given daily until the animal seems to get off feed and discharges freely from the eyes and nose, indicating something of a catarrhal disturbance of these mucous membranes. These conditions indicate that the treatment should be discontinued for three or four days. During this period a mild cathartic of epsom salts should be given, about one pound to 1000 pounds live weight. This should be dissolved in water and given as a drench. The iodide treatment may then be

continued for another period of six to ten days when it may be necessary to discontinue again and give another dose of epsom salts. Treatment should be continued until the tumor is reduced to about one-third of its original size; it may then be discontinued."

The statement has been made that one animal in every 1600 or 1700 cattle that go to the Chicago market has lump-jaw. The government inspection rule relative to the disease reads as follows:

"Actinomycosis, or lump-jaw: First, if the carcass is in a well nourished condition and there is no evidence upon post-mortem examination that the disease has extended from a primary area of infection in the head, the carcass may be passed; but the head, including the tongue shall be condemned. Second, if the carcass is in a well nourished condition and the disease has extended beyond the primary area of infection, the disposition shall be made in accordance with the regulations relating to tuberculosis."

BLACKLEG[1]

Blackleg, blackquarter, quarter-ill, or symptomatic anthrax is a rapidly fatal infectious disease of young cattle which was formerly regarded as being the same as anthrax, but recent investigations have definitely proved that they are entirely different diseases. It is caused by a minute rod-like bacillus which lives only in the absence of oxygen, as in the ground or in the tissues of animals. It enters the animal body by means of abrasions of the skin or of the mucous membrane lining of the mouth, throat, and other portions of the digestive tract. Foreign writers state that the disease is found among sheep and goats, but in this country it rarely, if ever, affects any animals except cattle. The disease may attack suckling calves, but is most likely to oc-

[1] The information here presented is taken from the Report on the Diseases of Cattle of the Bureau of Animal Industry, Bulletin 122 of the Kansas, and Bulletin 75 of the Virginia Experiment Stations.

cur in calves between six and eighteen months of age. It is not very common after two years of age and very rare after three, but occasionally occurs in aged animals.

The symptoms of the disease appear from one to three days after infection has taken place, and are characterized by a loss of appetite and rumination (chewing the cud), dullness, and a high fever, the temperature rising as high as 107°F. The disease is invariably accompanied by a tumor or swelling on one or more of the limbs, which causes lameness or stiffness. Sometimes the animal is stiff in the neck, all over, or in one side of the body. These tumors or swellings under the skin are the most important characteristic of the disease, usually appearing a few hours after the constitutional symptoms described above, but sometimes appearing before. The tumors may appear on the thighs, neck, shoulder, breast, flanks, or rump, but never below the knee or hock joints. At first these tumors are small, but they rapidly increase in size and become less painful, and in a few hours the circulation is arrested and the part becomes cold and painless. When stroked or handled, a peculiar crackling sound is heard under the skin due to gas formed as the bacteria multiply. When cut into, a frothy, dark-red, disagreeably smelling fluid is discharged.

The animal invariably dies in from one to three days, death being preceded by increasing weakness, difficult breathing, and occasional attacks of violent convulsions. After death the affected muscles look as if badly bruised and filled with thick, dark blood and gases. The muscle tissue is soft and easily torn. The features which distinguish the disease from anthrax are the unchanged spleen and the ready clotting of the blood. In anthrax the spleen is very much enlarged, the blood tarry, coagulating freely. The anthrax carbuncles and swellings differ from the blackleg swellings in not containing gas, in being hard and solid, and in causing death less rapidly.

Thus far no effective remedy has been discovered. Certain drugs seem to have been beneficial in a few cases, but a thorough trial has proved them valueless. Some recommend making long incisions in the swellings and allowing the fluid to escape and then washing the parts several times daily with an antiseptic solution. This treatment has not proved effective, and affords an excellent opportunity for the spread of the disease to other animals, as this fluid is full of the germs. Preventive rather than curative measures should be employed. The disease seems to be more common on wet, swampy pastures than on those that are more dry. When the disease appears in a herd, all healthy animals should be removed from the pasture and the affected ones allowed to remain. The disease is not directly communicable from one animal to another, but the fluid which may escape from the affected parts of diseased animals will pollute fodder, forage, etc. The bodies of dead animals should be burned to prevent the dissemination of the germs by dogs, crows, buzzards, and other scavengers. The burning should be done where the animal dies, as dragging or hauling from one place to another only serves to spread the disease germs. The body should not be opened, as this permits the escape of the germs. The pasture and other infected areas should be freed from the germs by allowing the grass to grow up and when dry burn it off and cultivate the land for one season.

The best method of prevention is by means of vaccination with virus which has been prepared from the meat of the affected parts of diseased animals. This vaccine is now prepared and sent out by the Bureau of Animal Industry and various State Agricultural Experiment Stations. As the methods of administering differ with the sample, and full directions accompany all that is sent out, there is no need of going into details of the method of application.

TEXAS FEVER[1]

It is not the purpose of the author to discuss the question of Texas fever from the standpoint of the Southern cattle raiser, but merely to give some of the precautions necessary to pervent its introduction into our great corn-belt and beef producing region.

The Texas fever, otherwise known as tick fever, splenic fever, or Southern cattle fever, is caused by a microscopic parasite *Piroplasma bigeminum* and the intermediate stage of the development of this parasite takes place in the cattle tick *Boophilus annulatus*, making this tick the indirect but absolutely essential factor in the natural production of the disease. Above the latitude where the cattle tick is destroyed by the cold of winter the disease can be thoroughly controlled by keeping Southern tick-infested cattle from passing through the country during certain seasons.

The Department of Agriculture has enacted sanitary regulations for the control of cattle shipments from the infected districts. The purpose of these regulations is to prevent the transportation of cattle ticks from infested areas to those that are not infested, either upon cattle or in stock cars or other conveyer, during the season of the year when infection is possible.

The quarantine line (the line south of which the fever exists), as determined in 1905, starts in Virginia, on the Atlantic Coast, and passes in a westerly direction through Virginia, North Carolina, Georgia, Tennessee, and a small portion of Kentucky, along the northern border of Arkansas and Indian Territory, thence through Oklahoma and Texas to the Rio Grande and the Mexican border, whence it passes along the southern boundary of New Mexico and Arizona and across the central portion of California to the Pacific Coast. Each year districts are being freed from the cattle tick

[1] The information here presented is taken from Louisiana Bulletin No. 82; Farmers' Bulletin No. 261; Bulletin No. 78, Bureau of Animal Industry.

and the boundary line gradually pushed farther south.

Cattle from the quarantined district may be shipped out without inspection between November 1 and January 31, inclusive (the open season), without restrictions other than may be enforced by local regulations at the point of destination. At the present time no cattle shall go out of quarantine, except for immediate slaughter, during the period between the dates February 1, and October 31 (the closed period). These cattle must be slaughtered within two weeks after arrival at their destination, and the regulations of the Secretary of Agriculture concerning their handling and movement shall be enforced. The following is an abstract of the regulations in force May 1, 1905:

"Cattle coming from the infected districts during the closed season can not be driven, but must be conveyed in cars or boats placarded, 'Southern cattle,' and bills of lading, way bills, and conductors' manifests shall have this information written upon them. When the cattle are unloaded for feeding, watering, or other purposes, they must be placed in pens reserved for such animals only, in which native stock is not allowed, and a large sign with the words 'Quarantine pens' or 'Quarantine yards' must be conspicuously placed on all such inclosures. On unloading at their destination, only the chutes, pens, and alleyways reserved for Southern cattle shall be used. Before the cars or boats are again used their entire interior must be thoroughly washed with water, after the removal of all litter and manure, and then disinfected with a mixture of 1½ pounds of lime and ¼ pound of 100 per cent carbolic acid to each gallon of water, or with a solution made by dissolving 4 ounces of cloride of lime to each gallon of water. All chutes, alleyways, and pens used enroute and at destination, but not reserved for the exclusive use of Southern cattle shall be so disinfected. Where animals are yarded adjacent to animals from above the line, at

least a ten-foot space not occupied by cattle must be left between, on each side of which shall be a tight board fence not less than five feet high."

In spite of all precautions that can be taken, there are occasional outbreaks of the disease north of the quarantine line. When such an outbreak occurs there are several ways of freeing the cattle of ticks: (1) picking or brushing them off; (2) smearing or spraying the animals with a disinfecting solution; (3) dipping the "ticky" animals in a vat containing a solution capable of killing the animals and not injuring the cattle; (4) the "soiling system."

Picking or scraping off the ticks.—This is a laborious undertaking but may be quite effective on a small herd, if care is taken to go over all parts of the animal frequented by the ticks, especially under the belly, around the tail, and on the inside of the legs. They should be scraped off with a dull knife or curry comb and burned. The cattle should be gone over at least three times a week during the tick season and should be frequently examined later to see that none are missed.

Smearing or spraying with a disinfecting solution.—In small herds, smearing the cattle with a mixture of one gallon of kerosene, one gallon of cottonseed oil, and one pound of sulphur, or with a mixture of equal parts of cottonseed oil and crude petroleum, or with Beaumont crude oil alone has proved efficacious when applied to the skin two or three times a week during the tick season. Where a large number of animals are to be treated, but not sufficient to make it advisable to construct a dipping vat, spraying the infected animals gives very good results if thoroughly done. Spray with Beaumont crude oil or a five per cent solution of any standard coal tar dip applied with a force-pump.

Dipping in a vat.— The Bureau of Animal Industry has been experimenting for a number of years on the subject of dips, and the most successful one found is Beaumont crude oil, obtained from certain Texas wells.

This is very successful in killing the ticks and at the same time does not materially injure the cattle, and has been found superior to any of the dips tested. After dipping, the animals should not be unduly exposed to the hot sun or driven long distances, but should be given plenty of good food and water. Dipping should not be done till after the cattle have shed their winter coats. The method usually adopted in dipping cattle is to construct a narrow swimming tank with a chute at one end for the entrance of the cattle, and a sloping exit and a dripping floor at the other.

The "soiling method."— This method of freeing the cattle of ticks is based upon a knowledge of the life history of the ticks. The time required for the female tick to lay eggs and the latter to hatch, in other words, the time spent on the ground, is rarely less than three weeks, and the time required for the seed ticks to molt and mature, or the time spent on the cattle is usually from twenty to forty-five days. When the cattle are to be freed from ticks, they should be kept in a small tick-free enclosure for three weeks, when many of the ticks will have fallen off. They should then be removed and placed in a similar enclosure for another three weeks, and to make sure of the job, they should remain two weeks in a third enclosure. By this time the youngest ticks that were on the cattle at the start will have matured and dropped off, and as the animals are removed from each pen before they could possibly have become reinfected with seed ticks that hatch from the eggs of the females that fell off, they are now tick free. The same pens cannot be used repeatedly for this purpose without thorough disinfection. Care should be taken that hay fed the animals in these pens is from non-infested fields.

Morgan, of the Louisiana Station, has outlined what is known as the "feed-lot" method of ridding cattle and pastures of ticks during a single summer. In this method a portion of ground is set apart, one-half of

which is sufficiently large to accommodate the number of cattle on hand. The area selected should be convenient to plenty of feed and water. Surround and divide the lot with a double fence, leaving a space of eight to ten feet. As the ticks can crawl only a short distance, there is thus no danger of their getting from one side to the other or outside of the inclosure. Feed the cattle for twenty days on one side, then remove them to the other side for fifteen or twenty days longer. By this time every tick will have dropped and the cattle can then be placed on tick-free pastures. After the animals are removed the feed-lots should be immediately plowed and thoroughly cultivated, and their edges completely sprayed with crude petroleum, zenoleum solutions, or other substances destructive to tick life. By this method entire farms may be cleaned in a single summer of not exceeding four months.

CHAPTER XXI.

EQUIPMENT FOR CATTLE FEEDING

Figure 14 is taken from a photograph of a very satisfactory open shed and feed storage building. The shelter consists of a building twenty by twenty-six feet, twenty-foot posts, with two wings each twenty by thirty feet. This makes a shelter twenty by eighty feet. The upper floor of the middle portion is used for the storage of feed, which is fed out into the bunks below. Another bin ten by twenty feet occupies the lower floor of the main building, which is used for the storage of corn. The yards and shelter are designed to accommodate about fifty cattle. The paved lot adjoining is twenty-four by eighty feet, the bricks are laid flat on six inches of gravel, the latter being packed by the tramping of horses until a solid surface was secured. Cement wash was applied after the bricks were laid. The curbing consists of curb-stones eighteen inches wide and three inches thick set edgewise into the ground. Adjoining the paved lot is a yard containing about one-half acre in which the hay rack is located and where the cattle are allowed to remain a large part of the time.

FEED-BUNK WITH PLATFORMS FOR MUDDY LOT

The floors are made by placing five white oak sixteen-foot two-by-fours on edge, and laying a floor on them of two-inch plank cut in six-foot lengths, making a floor six by sixteen feet. The two-by-fours are beveled at each end like sled runners, and a hole bored in the end of the middle plank for a clevis so that the floor can be dragged around.

The bunk should be constructed of oak, as it is the most durable and the cheapest in the end. The bed

or box should be made of 2 x 6 inch stuff, the sides and bottom 16 feet long and the ends 3 feet wide. This makes a box the inside dimensions of which are 3 feet by 15 feet 4 inches (3′x 15′ 4″) and 4 inches deep. The six posts should be 4″ x 4″ and 2′ 6″ high, and beveled off at the top so as to shed water and prevent the sharp

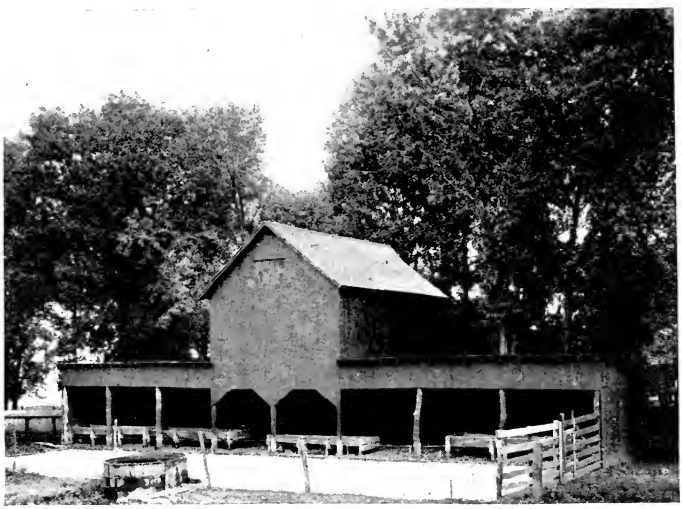


Fig. 14. Open shed and feed storage combined. In use by E. E. Chester, Champaign Co., Ill.

corners injuring the cattle. The cross ties under the feed box should be 1″ x 6″, and long enough to reach across. The ties running lengthwise, instead of being crossed as shown in the accompanying cut should be 2″ x 6″ x 16′, extending straight along the side of the bunk.

After the bunk is made it should be turned over and two-by-fours nailed to the bottom of the posts, allowing them to project six inches past the sides of the post on each side. The floors should then be placed in position,

about three feet apart, and the bunk set upon them. The bunk is secured to the floors by boring a hole through the two-by-four on the bottom of the posts and on through the floor, and dropping in an old bolt, which prevents the bunk and floors from being pushed out of place. Three bunks of the dimensions given will be enough to accommodate fifty cattle. The bunks should be arranged in a row. This is a great convenience in feeding, and cattle so fed are not running from one bunk to another, dropping feed as they go. These floors keep the feeder and the cattle out of the mud, and all droppings or waste feed fall upon them and the hogs have a chance to get it before it is lost in the mud.

THE PAVED LOT; HOW TO MAKE AND USE IT

The question of feed lot conditions has not received the consideration at the hands of cattle feeders that its importance merits. Perhaps the most neglected factor is the surface of the yards or lots in which cattle are fed during the winter months. The importance of this subject is emphasized by the statement of a prominent cattle buyer at a leading market, who said, "You can tell the farmers and feeders of this country that in feeding cattle there is nothing more certain than that dirty hides from allowing cattle to wallow in mud or manure is sure to make a big loss, no matter how well bred or well fed the cattle may be. I visited the farm of a man who has fed market toppers and international prize winners, who allowed his cattle to stand in manure knee deep. Nevertheless, cattle with manure-covered hides will have to sell 10 to 15 cents and sometimes 25 cents per hundredweight less than those with clean hides." The same authority stated that with yards in which the steers could be kept clean, gains could be put on with much less feed than where the cattle were compelled to wade about in the mud. The Illinois Experiment Station has conducted some experiments which furnish some data on these two important points. First,

as to the relative selling qualities of cattle kept clean and those fed in muddy lots. In the six months extending from Nov. 28, 1903, to June 1, 1904, the Experiment Station referred to fed a carload of choice 2-year-old steers on a paved lot and another carload of the same grade of steers in an ordinary mud lot. Of course both lots were fed the same ration, and all conditions, save the matter of the surface of the feed lot, were the same. When marketed in Chicago the steers fed in the mud

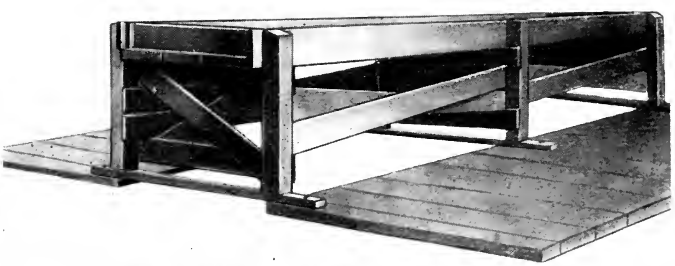


Fig. 15. Bunk in which to feed grain to cattle, with platform approach. In use by J. R. Fulkerson, Jerseyville, Ill.

lot sold for 10 cents per hundredweight less than those having access to the paved lot. This was due to their dirty appearance and not to any inferiority of finish which they possessed, for strange as it may seem, the paved lot did not seem to make it possible to make larger or cheaper gains, considering the steers by themselves. The pigs following the steers having access to the paved lot, however, made nearly one pound more of pork per bushel of corn fed the steers than did those following the steers fed in the ordinary mud lot. In other words, while the pork produced by the pigs following the "mud lot steers" paid for only 12.86 per cent of the total feed fed to steers, the pigs following the "paved lot steers" paid for 16.67 per cent.

There seems to be good reason why the mud lot steers made as good and as cheap gains as did those in the paved lots. Those in the mud lot had access at all times to an open shed, the bedding in which was kept dry at all times. This shed was large enough for all the steers in the lot to lie down at the same time. The feed bunk in which the corn was fed was only about 15 feet from the shed and the water tank about 20 feet. The weather was such that the mud lot was not in bad condition any very large part of the time. It was observed, too, that the steers in the mud lot spent much more time in the shed than did the lot of steers having access to the paved lot of the same size. In other words, the mud lot steers were not obliged to wade or stand in the mud to any considerable extent. Steers subjected to a mud lot with no suitable place to lie down must suffer, and when a steer is uncomfortable he is not making gain economically. In the experiment cited where conditions were as favorable for mud lot cattle feeding as could be expected, the falling off in pork produced is no inconsiderable item, amounting to $1.50 per steer, with pork at $6 per cwt. The writer believes that cattle will not drink as much water as they require if obliged to wade through deep mud to get it. The possibility of saving a large part of the manure by the use of the paved lot should be a strong argument in its favor. Paving with brick is not, of course, the only way to keep cattle out of the mud, but it is one way which gives promise of permanency although expensive at the start.

HOW TO PAVE THE FEED LOT

The grade should be established slightly above the surrounding surface level to prevent any surface water from flowing onto the pavement. The slope given to the pavement will depend upon its location in reference to sheds, other lots, and natural or artificial drainage. The paved lots at the Illinois Experiment Station have a fall of 1 inch to 6 feet away from the open sheds. There

is also a side slope to each lot with a tile at the lowest corner to carry off surface rain water that falls on the pavement. As the pavement is frequently cleaned there is no serious leaching of manure.

After the proper grade had been secured the ground was covered with 6 inches of gravel, which was rolled and tamped down solid, covered with 1 inch of fine sand upon which No. 1 paving brick was laid flat, herring-

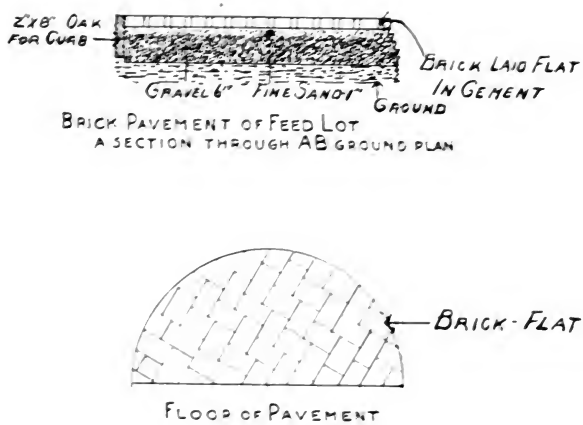


Fig. 16.

bone pattern, except in the alley and around the scales, where they were placed on edge. After being put in place, the bricks were rolled down even, and upon inspection, if any were found to be soft they were replaced with good ones.

The space between the bricks was filled with a grout "filler" consisting of one part clean, sharp sand and one part of Portland cement. The cement and sand were thoroughly mixed dry in tight boxes, then made into a mortar of the consistency of cream and thoroughly broomed into the joints. The slushing was repeated to insure the filling of all cracks or joints between the

bricks. This was done to keep the water from getting underneath the pavement which, if allowed to enter, would soften the subgrade or cause the heaving of the bricks by alternate freezing and thawing.

The cement filler was allowed to set a week before heavy loads were driven on it, and as the work was done in summer, the sun's rays were kept off by means of a canvas for the first day. A retaining curb of 2 x 8 plank, braced by a 4 x 4, placed 2½ feet in the ground, was put in at the gates to keep the animals from breaking the edge of the brick.

The writer has seen pavement thus constructed that has been in use for nine years and is still in good condition.

THE SELF-FEEDER; HOW TO MAKE AND USE IT

The self-feeder, or feeder as it is sometimes called, is a feed box so arranged that it will hold a considerable quantity of concentrated feed, a portion of which is accessible to the cattle at all times.

No records are available touching upon the question of when and with what class of live stock it was first used. However, it is no new system of feeding for it has been in use for a considerable number of years.

The extent to which the self-feeder has been used has varied much, its use in some localities being quite general, and in others scarcely known at all.

HOW TO MAKE A SELF-FEEDER

The plan and construction of the self-feeder will, of course, depend largely upon the nature of the feed which is to be fed through it to fattening cattle. In the corn-belt, and in fact wherever beef cattle are extensively fed in the United States, corn in some form is the principal concentrate used. Corn has been successfully fed to cattle in self-feeders in the following forms: broken ear, shelled, crushed, corn and cob meal, and corn meal. As indicated above, it is necessary to make minor alter-

ations in the feeder to permit the corn in these various forms to feed down properly. The essentials of a good self-feeder are as follows:

Storage for sufficient feed for the cattle having access to the self-feeder for several days should be provided. The opening from the storage compartment of the feeder

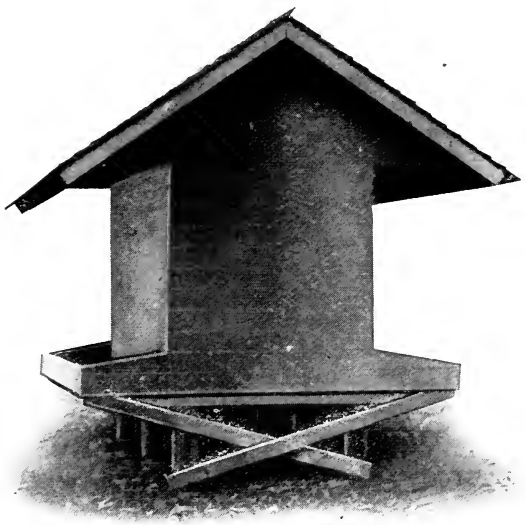


Fig. 17. A small Self-Feeder.

to the trough should be capable of such adjustment that the feed should at all times be available to the cattle. That is to say, it should not be so constructed that the cattle have access to large quantities of the feed at any one time, as this occasions considerable waste of feed and loss of appetite of the cattle by their slobbering and mussing over it until it is unpalatable. Unless this feature of the feeder receives careful attention and adjustment the self-feeder will prove more or less unsatisfactory. A construction which makes it necessary for the

cattle to work a little to get the feed is desirable. Where feeds and their preparation are varied from year to year it is not an easy matter always to have the self-feeder working in the most satisfactory manner. In a number of instances it has been necessary for the cattle feeder to visit his cattle daily to examine the feeder and see that it is working properly. It may be argued that if in the use of the self-feeder it becomes necessary to see the cattle daily the claimed advantage of the use of the self-feeder as a labor saver is unwarranted. To a certain extent this is true, but whether the self-feeder is used or not there is force in the old adage, "The eye of the master fattens his cattle," and the wise cattle feeder will plan to see his fattening cattle frequently.

TROUGH SHOULD BE LONG

Another desirable feature in the self-feeder which should be provided for is that the trough out of which the cattle secure their feed should be sufficiently long to accommodate, at the same time, practically all of the cattle having access to it. The dimensions of the self-feeder should therefore be determined by the number of cattle to be fed. There is no one type of self-feeder that is better than all others; indeed the type of feeder should vary according to where and how it is to be used. The main thing is to see that the essentials of a self-feeder, enumerated elsewhere, are observed. Some cattle feeders have so planned their sheds or barns that the self-feeder is located along one side or through the center of such building. Others have made the self-feeder a part of their storage cribs for corn. The self-feeder here described will accommodate ten to twelve cattle weighing from 900 to 1400 pounds each. It is designed to use in the open field or in the pasture for summer feeding. It may be placed on posts set in the ground or it may have a base built as a part of the self-feeder. There is an advantage in having several small self-feeders over one large one where a large number of

cattle are to be accommodated, viz., the smaller feeders can be moved when it becomes muddy about the feeder and where occasion requires they can, if built strong enough, be moved from one field to another. The height of the floor of the feed trough should be from twenty-four to thirty inches, depending upon the age and size of the cattle fed.

By referring to the sketch (Figure 17 and 17A), it will be seen that the outside dimensions of the box for storage of feed are 12 feet 2 inches long, 5 feet 6 inches high, and 4 feet 4 inches broad. This box or storage bin has a capacity of approximately 180 bushels. The detailed drawing, or sketch, will show the construction of the hopper bottom, feed troughs, roof, door, etc. The drawing does not correctly illustrate that the hopper bottom of the storage bin lacks four inches of coming out flush with the wall of the bin and that the opening left for feed to feed out of the hopper into feed troughs is two and one-half inches wide. This width of the opening and pitch of the bottom of bin should vary with the kind of feed to be used. That is, if broken corn is used a much wider opening will be required; if shelled corn, a narrower one. The opening left in this case was for feeding meal. Six-inch flooring was used for the sides and floor. A shingle roof is of course unnecessary, but was used in this case, the shingles being laid four inches to the weather.

BILL OF MATERIAL NECESSARY

The following is a bill of materials necessary to build the feeder, as illustrated:

Seventeen pieces 2x4, 16 feet; six pieces 2x6, 16 feet; one piece 2x6, 8 feet; twenty-four pieces 1x4, 16 feet; two pieces 6x6, 12 feet; thirty pieces 1x6, 12 feet; one piece 6 x 8, 18 feet; 1700 shingles.

Nails, paint, and labor, together with the materials itemized, make this feeder cost from $30 to $35, depending upon the grade and price of materials used. In

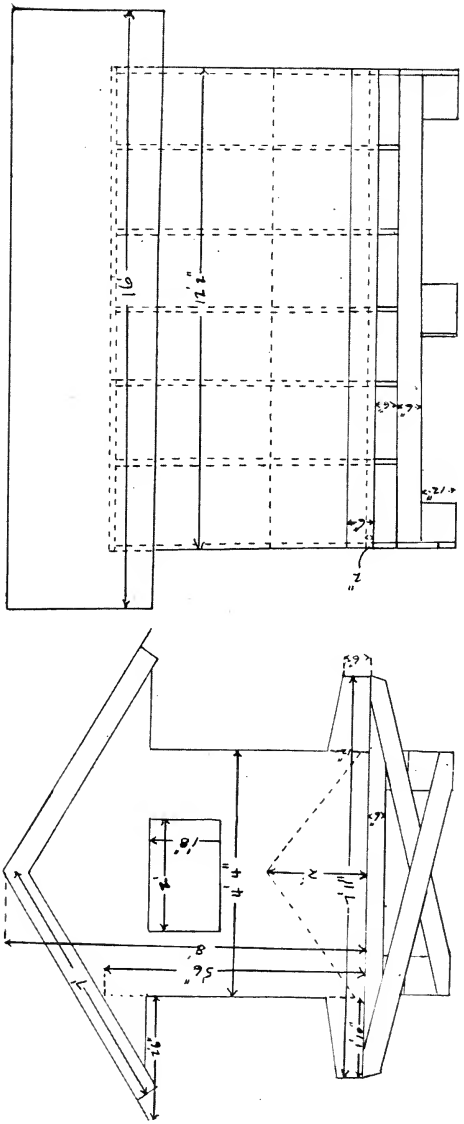


Fig. 17A. Detail of Self-Feeder shown in Fig. 17.

all that has been said concerning the use and construction of the self-feeder with fattening cattle, the writer does not wish to be understood as especially favoring its use. We do wish to say, however, that where properly constructed and judiciously used and where for various reasons its use seems desirable, it may be used to good advantage. Where its proper use in the economy of cattle feeding is understood, it is not necessarily a wasteful or hazardous method of finishing cattle. It is not, however, a device that can be advantageously or even safely used by those who are inexperienced or who fail to familiarize themselves with its limitations.

HOW TO USE THE SELF-FEEDER

It has generally been considered that the chief point of advantage of this system of feeding is the economizing of labor. While this item is frequently an important one, it is by no means the only advantage following the use of the self-feeder in fattening cattle. Another is suggested in a statement of a prominent and successful Illinois cattle feeder, viz.: "It is more reliable than a careless man and more economical of labor than even a careful man."

WHAT FEEDERS THINK OF IT

A brief consideration of some of the advantages and disadvantages of its use forms a good basis for discussion of this subject. A few statements representative of those who name disadvantages of this method of feeding are quoted below from circular 98 of the Illinois Experiment Station:

"It cannot be safely used to start cattle on feed." This is in substance the reply made by several feeders, most of whom use the self-feeder, but who do not turn the cattle to it until they are accustomed to a liberal grain ration. Bad results following the use of the self-feeder have invariably occurred where proper care has not been exercised in getting the cattle on full feed

before turning them to the feeder. In the opinion of the writer the place to use the self-feeder is with long fed cattle—that is, cattle that have been fed corn liberally from three to four months.

"Cattle do not eat regularly." The following replies also bear upon this point: "Cattle eat more than they will assimilate." "It is like a man eating at all times; he soon regrets it." "Cattle glut themselves." "Cattle have too much feed at the start; therefore get off feed more easily." "Had four steers foundered last year."

It should be added that with the exception of the one last mentioned these statements are made by men who are not using the self-feeder and do not mention ever having used it.

"Cattle lose their appetite sooner than by hand feeding." "Prefer to have steers get hungry." "Like to have cattle clean up feed every day." "Slobber over corn and do not eat it so well." "Cannot mix oil meal, bran, etc., to good advantage." "Cattle need variety of feed." "To give this I feed in bunks once a day in addition to self-feeder." "Eat less, gain less." "Cattle should clean up feed an hour after every feed."

"The tendency is to neglect cattle." "Cattle are not watched closely enough." "Cattle are not so gentle." "The best self-feeder is the man who has his money in the cattle."

"Cattle waste feed by licking out and slobbering over it." "I use it when corn is not too high." "Opening gets clogged, due to damp weather or slobbering of cattle." "Damp weather causes feed to become lumpy or stale."

CATTLE WILL EAT AS THEY REQUIRE

Considering these objections a little more in detail, it may be said that where a judicious use of the self-feeder is made cattle will eat as they require. They may or may not eat regularly, but in our experience they make their visits to the self-feeder with remarkable

regularity. If, previous to being turned to the self-feeder, the cattle have been worked up to a maximum grain ration slowly and gradually, they will not consume an excessive amount of concentrates, and it is doubted whether under such conditions they will eat so much that they will fail to assimilate a normal amount of what they consume. Cattle eating too much and getting foundered when turned to the self-feeder comes from attempting to get the cattle on the self-feeder too quickly.

Cattle will undoubtedly eat more where the self-feeder is used than where it is not. They will also usually make greater gains in the former than in the latter instance. Experiments indicate, however, that under the most favorable circumstances for the use of the self-feeder, it requires slightly more feed to produce a given gain than where cattle are intelligently fed at regular intervals according to the common practice. This difference under favorable conditions is so slight that it could not be said to be a strong argument against the use of the self-feeder. The larger consumption of feed and greater gains undoubtedly tend to shorten the period of profitable full feeding.

Almost all concentrated feeds and mixtures have been successfully used in self-feeders. Undoubtedly this system of feeding has appealed strongest to the careless and indifferent cattle feeders, who are persistently seeking methods that require little effort on their part, and, as a consequence, many careless cattle feeders have employed this method and have condemned its use because they have not understood and heeded its limitations.

DOES NOT PERMIT OF WASTE

Some of the objections raised may be disposed of by saying that a properly constructed self-feeder does not permit the cattle to muss and slobber over any considerable quantity of the feed.

Before leaving this subject I wish to call attention to the possibility of using the self-feeder to advantage from the start. This may be accomplished by chaffing or cutting the roughage and mingling it with the concentrate fed before delivering the feed to the self-feeder. By mixing a large proportion of roughage with the concentrates fed at the beginning, the cattle may be safely turned to the feeder as soon as they are received from the market or as soon as they are placed in the feed lot. As the feeding progresses, the proportion of roughage should be reduced as the concentrates are increased. By actual trial this has proved a very good system for short fed cattle, and, as far as the writer's knowledge extends, the very safest method of getting cattle on feed quickly. This has been fully explained in a preceding chapter.

PART II.

BREEDING BEEF CATTLE FOR THE MARKET

CHAPTER XXII.

BREEDING FOR BEEF

The percentage of the total number of farmers in the United States who are specialists has never been determined, and while there is undoubtedly a tendency toward increasing this percentage, it is still sufficiently small to call for comment. Excepting those, of course, who are making a specialty of producing feeding cattle, there are very few specialists who breed beef calves. But among the so-called general farmers there are very few indeed, who do not breed a few calves each year, which, if not fattened for market or home consumption by the producer, ultimately find their way into the hands of cattle feeders who make a business of fattening or finishing cattle for the market.

If the question were asked, "How general is the interest in breeding beef cattle throughout the United States?" the answer would be unhesitatingly that interest in this subject is confined to the West and Southwest. More thoughtful consideration of the subject will, however, reveal some interesting facts.

Cattle from the range country are a conspicuous factor in our fat cattle and feeding cattle markets; so much so, indeed, that there is some danger of the native supplies being overlooked. The multitude of men who produce a few head each furnish a supply, which, in the aggregate, form a very considerable factor in our leading

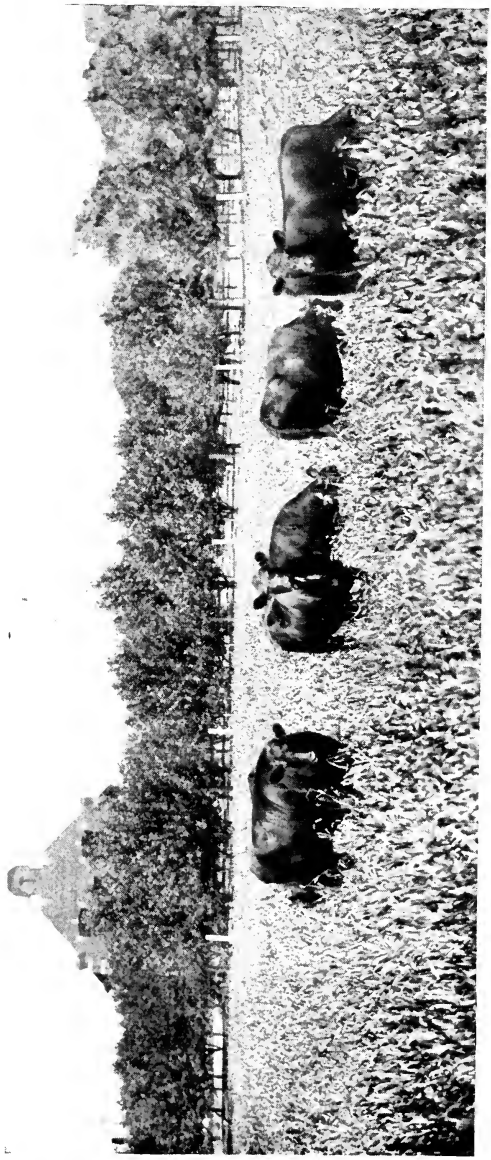
markets. It is true that each small producer has no identity nor is by himself to be considered an important factor in the production of the world's supply of beef, or, in other words, he or even a large number of such producers could discontinue their small operations without its producing even a ripple in the market. It is not from the standpoint of the influence of such individuals upon the market that this subject is to be discussed, but rather from the standpoint of these small producers, who, in the opinion of the writer, will become more, rather than less, numerous, and hence constitute a more important factor in the meat trade. We have shown how a very large number of farmers are producers of beef cattle, and while a large percentage produce only a few head each year, those few head must of necessity be either profitable or unprofitable to them. They must consume farm products which should be consumed by cattle which will pay the highest market prices for them. Well-bred cattle of the beef type only will do this if the primary object in view is the production of beef. If combined beef and milk is the object sought, then the dual purpose type should be selected. It is the purpose to discuss at this point the question of breeding cattle where beef production is the primary object, leaving for a subsequent discussion the question of the dual purpose cow in her relation to beef production.

SELECTION OF COWS AND HEIFERS

Undoubtedly the selection of the bull to head a herd is of much greater importance than the selection of the females composing the herd. However, it has seemed to the writer that not enough importance is attached to the selection of the cows. While good steers may result from mating common cows with a well-bred beef bull, better ones are secured from well-bred cows, and there are fewer common steers resulting from such a mating.

If common cows are used, common steers will surely be bred all too frequently. It should therefore be the

policy of the breeder of market beef cattle to use high-grade cows of some one of the beef breeds. The owners of herds of scrub or common cows may accomplish this end either by selling out and purchasing high-grade females or by grading up from the cows already on hand by successive crosses of beef bulls of approved merit. Where the financial circumstances of the breeder will permit of the former plan it is unquestionably the most rapid and satisfactory means of arriving at the end sought. Whether Herefords, Aberdeen-Angus, Shorthorns, Galloways, or Polled Durhams should be selected will depend upon the breeder's personal preference and the conditions which prevail. Good individuals of any of these breeds if properly mated will give satisfactory returns. Each breed has its peculiar advantages and when these are understood and recognized there exist good arguments in favor of each. The Herefords are excellent grazers and mature early. The Aberdeen-Angus produce high quality of beef and are much sought in our markets as fat cattle. Their hornless character recommends them to those desiring a polled race. The Shorthorns nick well with common cattle and other beef breeds. They are widely distributed, easily available, and quiet in disposition. Galloways are hardy and produce high quality of beef. They are hornless. The Polled Durhams resemble the Shorthorns in appearance and characteristics and are preferred to Shorthorns by some because of their being polled. As has been stated, high grades of any of these breeds will prove satisfactory; however, they have characteristic differences in form and development which render it advisable not to have the cow stock partly of one breed and partly of another. In the interest of uniformity all should be grades of the same breed. It is not so important to select a particular breed as to secure choice individuals of whatever breed seems most desirable under the circumstances. The fact that a cow or heifer is a high grade of some one of the beef breeds does not in itself insure satisfactory qual-



A group of Aberdeen-Angus breeding cows at the University of Illinois.

ity. There is a wide difference in individuality between different animals of the same breed. The matter of selection of individuals within a breed may thus become a more important matter than the selection of a breed. Select as far as possible females which conform to the standard of excellence of the breed. If this is accomplished it will insure a uniformity in type that is highly desirable. If in addition to this it is possible to select cows and heifers that are similarly bred, they will be more likely to produce uniformity in their offspring and a uniform lot of stockers, feeders, or fat cattle sell for more than an uneven lot.

There are a few general considerations in selecting beef cows which should be mentioned, such as form, quality, and constitution. The main characteristics to be sought in form are shortness of leg, breadth, and a general smoothness, good top and underlines, full flanks, and straight legs. The bone, head, and hair should indicate quality as opposed to coarseness on the one hand or delicacy on the other. A good constitution is evidenced by a broad, deep chest, a good heart girth, and a lively condition of the coat of hair.

SELECTION AND USE OF BULLS

There is perhaps no other important factor connected with beef production that is as often disregarded as that of the selection of bulls to head the herds of grade cows from which are produced the feeding cattle of the country. The importance of this item can not be generally recognized, for, if it were, there would be a strong demand at good prices for every good pure-bred bull of the beef breeds that is offered for sale. As it is, there are many good bulls that breeders are obliged to sell at prices which render the breeding of pedigreed beef cattle by no means the most remunerative of enterprises. It is still true that "the bull is half the herd," and he may be more than half the herd if he is a choice individual backed up by good ancestry. A brief discussion of the

importance of the selection of a sire should tend to a more active demand for the better grades of registered beef bulls. In the first place, the writer wishes to go on record as saying that the breeder of feeding cattle, whether he fattens them himself or sells them to cattle feeders, can not afford to use a common bull of indiscriminate breeding. There can be no doubt about that. Feeding cattle that are well-bred and possess quality enough to weigh one thousand pounds or better at two years old are worth all the way from $40 to $50 per head, depending upon their individual quality and condition. Such feeding cattle can be and are produced from grade beef cows mated with choice registered beef bulls. Common and inferior feeding cattle that are produced from common cows and scrub or grade bulls frequently attain an age of three or more years before they reach one thousand pounds in weight. Such feeders at such an age and weight are worth from $27 to $30 each. The lesson should be plain that it does not pay to use an inferior bull that sires the steer that pays the owner but $9 per year for his keep as against the one that pays $22 to $25 per year. It may be claimed that the fault is not altogether with the bull. We grant that. But suppose the cows are the same in either case, the well-bred beef bull will produce feeding cattle which will grade at least two grades higher than the feeding cattle produced by the mediocre bull. There is usually about thirty-five cents per hundredweight difference in price between one grade of feeding cattle and the next higher. If the well-bred bull raises the grade of his offspring two grades, he adds to the value of each animal he sires seventy cents per hundredweight or to the one thousand pound steer seven dollars. Properly cared for, a bull should sire from forty to fifty calves in a year. For sake of argument, suppose we say he sires forty. If he should increase the value of each of his offspring but $5, a very conservative estimate, he earns at the least $200, with his first crop of calves. At the present time, there are plenty of regis-

tered beef bulls of the various beef breeds that are well calculated to sire choice to fancy feeding cattle that can be purchased at from $100 to $200 each. It is no exaggeration to say that as compared with the use of an inferior bull the registered beef bull pays for himself the first year. The most hopeful condition surrounding the production of beef cattle to-day in the United States is the supply of choice bulls that can be secured at relatively low cost. There is, however, in this a danger to the future of beef cattle interests in this country. Breeders of choice registered beef bulls can not long afford to sell the kind that will produce high class beef steers at prices at which certain beef producers insist upon buying them.

We have inferred that the bull selected should be pure-bred and that his ancestry should be of the best. We would insist upon this as the only reasonably sure way of insuring beef excellence in his offspring. Not only should a high standard of individual excellence be demanded in the ancestry of a bull, but attention should also be given to their records as producers of stock of high quality. If one is familiar with the methods of the breeders of the ancestry, the pedigree may also be an indication of the conditions under which the bull and his ancestors have been developed. The breeder and his methods should be taken into consideration as well as the appearance of the cattle. Many pampered bulls prove disappointing when put to the actual test of heading a herd of beef cows. It is always assumed that a good individual possessing the type and characteristics of a beef sire should be selected. These points have been so frequently described that extended notice of them here is unnecessary. However, there are some points which should receive especial consideration, viz., constitution, quality, character, and masculinity. These points while difficult to define are quickly recognized by the practiced eye of the experienced cattleman. Some lack of breed, type, or character may be sacrificed in a steer breeding bull provided their absence is not

attended with an absence of qualities which make for the production of a more profitable feeder's type. Calves and yearlings are frequently purchased as sires because they can usually be purchased for fewer dollars per head or because their period of usefulness is likely to be longer, or, perhaps, it may be because the young bull in full flesh looks better. It is a mistake to discriminate against an aged bull that has proved himself a valuable sire.

MANAGEMENT OF THE BULL

Breeders differ in their opinion as to whether the bull should be allowed to run with the cows. The writer believes it advisable to keep the bull by himself in a well fenced pasture lot provided with shade and shelter. If it can be made sufficiently large to furnish ample pasture for the bull, so much the better. By keeping the bull confined and breeding the cows as they come in season it is possible to keep a record of when the cows will calve. A bull so handled can also serve a larger number of cows during the year. The number of cows which a bull should cover in a year will depend upon his age, condition, and treatment, together with the distribution of the cows bred to him. The number should vary from thirty to sixty in a year.

The feed of the herd bull should be nourishing, but not too concentrated or heating. The best of roughage in the way of clover hay or alfalfa and silage or roots should be used. A small percentage of corn with a large percentage of oats and bran constitutes a satisfactory ration. The amount to be fed will vary according to the age, weight, and condition of the bull as well as the work required of him. He should be kept in good, thrifty condition, and if it is found that it requires an abnormal amount of feed to maintain this condition, in other words, that the bull is a "hard-keeper," he is not well calculated to sire cattle possessing good feeding qualities, and should be replaced.

CARE AND MANAGEMENT OF THE HERD

There are numerous details in the care and management which are matters of local interest, and these can not well be considered in this discussion. Such general questions, however, as the best season to have calves dropped, the age at which to breed heifers, and the best age to dispose of females are points worthy of careful consideration.

WHEN TO HAVE CALVES DROPPED

The consensus of opinion is that, everything considered, it is best to breed the cows so they will calve during the spring season. The arguments in favor of this system are that the cows may be wintered cheaper when not in milk with calves at foot. They require less room for shelter, less careful attention from the attendant, and less protection from the cold. If the calves are dropped in the fall it is hardly possible to finish them without carrying through two winters, whereas, if dropped in the spring, they need not be wintered but once, being finished at the age of eighteen to twenty months. If, too, the cattle are marketed at the ages noted, they will have the benefit of two summers of grass, whereas when dropped during the fall season, in order to get the benefit of two seasons of grass, they must be carried until they are from twenty-four to twenty-six months of age. On the contrary, it is argued by some who favor the fall calf, that a better animal can be produced and developed by this system, because the cow in the fall is in better physical condition to deliver her calf after a period of summering on pasture; that the cow's flow of milk, which has freshened in the fall, will be getting limited by the time she goes to grass and the grass will have a tendency to produce a more abundant supply for the calf; that the calf at that age and time is better able to handle pasture grasses to an advantage than when younger, and to endure heat and the fly season more easily. There is undoubtedly force

in some of these arguments, but the writer believes the advantages of the spring calf outweigh those of the fall calf, with reference to the growing of cattle for beef in the corn-belt.

BREED CALVES UNIFORM IN AGE

Care should be taken to breed the cows in such a way that the calves will be as nearly uniform in age as possible. This will necessitate the weeding out of the herd cows which persist in coming in season only after long periods have elapsed after calving. Such cows are not necessarily shy breeders, but, for the reason stated, should be discarded. The margin of profit in breeding beef cattle is so slight that the producer can not long afford to board the shy breeder.

The herd should be frequently and carefully culled. The basis of selection or standard of excellence after the individuals have been tested should not be alone their conformity to score card standards of form and condition, but primarily their records as breeders. It sometimes happens that some of the plainest looking cows are the best producers. These should most certainly be reserved for future use even though they are not pleasing to look upon.

AGE TO BREED HEIFERS

The question is often asked, "At what age should heifers be bred?" Assuming that heifers have been liberally fed and have attained normal size for their age, they may very properly be bred at from eighteen to twenty months of age. In case the heifers are undersized and lacking in development and condition, the breeding may be postponed for another six months. It ought not to be necessary, however, to keep a heifer until she is two years of age, or upwards, before breeding. Undoubtedly, many of the most satisfactory breeding cows will be found among those that have reached six to nine years, and in general it is bad practice to discard

an especially good breeder at such age simply because she will deteriorate in value if kept longer. On the other hand, the necessity of watching every corner to avoid unnecessary losses leads to the conclusion that females should be replaced with younger stock before they have deteriorated materially in value. This usually means that cows should be sold when in good condition at eight years of age or even younger, but should by no means be applied to those which have proved regular and prepotent producers of satisfactory calves.

Male calves should be castrated before the calf has reached an age of three months, and this may be done when the calf is less than one week old.

The feeding of a herd of cattle maintained for the purpose of breeding calves intended for developing into beef may best be considered under the general divisions of (*a*) summer and (*b*) winter feeding.

SUMMER FEEDING

If pasture is of good quality and abundant the cows and calves will require but very little attention during the pasturing season. The calves should be weaned at from six to eight months of age. If spring calves only are produced and the cows are provided with an abundance of pasture, there will be no need of supplementing the pasture with concentrated feeds as far as the cow is concerned. If, however, pastures are sufficiently short materially to affect the milk flow of the cow, the pasture should be supplemented with silage, clover or alfalfa hay, green forage, or concentrated feeds. The calves should be taught to eat grain before being weaned to prevent shrinkage at weaning time.

Cows and calves at pasture should have access at all times to fresh, pure water, shade, and salt.

The question of winter feeding of breeding cows requires separate treatment.

WINTER FEEDING OF BEEF BREEDING COWS

The kinds and amounts of feeds used in the winter feeding of beef breeding cows should be governed to a large extent by the condition of the cows when they go into winter quarters. The character of the shelter best adapted for cows will be determined by the condition of the cows and the feed which they receive.

With the factors mentioned, more or less dependent upon each other, it is necessary, in order to discuss this subject intelligently, to assume certain conditions. These assumed conditions will in most instances be those which are most commonly met with, or those which the writer believes to be most characteristic.

It is assumed that the climate and other conditions necessitate dry lot feeding and some provision for shelter for five to six months.

The end sought in the feeding and management of a herd of beef breeding cows is, of course, to maintain them in such thrift and flesh as will render them best able to give birth to and suckle well their offspring, with as small an expenditure of expensive feeds as possible. That is to say, the cattle raiser, on the one hand, can not afford to maintain such a herd largely on concentrated feeds having relatively high market value to insure desirable condition, nor, on the other hand, can he afford to so stint the amount or quality of feeds that they are so emaciated and weak as to give birth to delicate calves, which they can scarcely nourish on account of their insufficient flow of milk.

Cows used for this purpose should be dehorned or natural polls, as they can thus be run in large droves and cared for much more economically than can horned cows. If dehorned, a considerable number of them will run together quietly; and if calves are dropped in the spring, except in the most northern climates, the cows will require no other shelter than a shed open to the south. Such cows should go into winter quarters in good, thrifty condition after weaning their calves. By

good, thrifty condition we mean the condition in which the animal is fleshy but not fat, about as fleshy as they would be expected to go on grass the following spring. With this condition to start with, the feeder has simply to maintain that weight, or better, keep them gaining slightly, through the season. This gain should always be slightly more than sufficient to account for the growth and weight of the fœtus.

We would brand as gross mismanagement the practice of premitting the cows to run down in noticeably thin flesh, making it necessary to feed lavishly during part of the season to regain flesh lost during a corresponding season of neglect. The most satisfactory results in breeding and rearing calves and, we believe, the most economical system of maintenance of such herds, involves the keeping of the cows composing the herd in good, thrifty condition throughout all the year.

The proper feeding of such a herd during the winter season is frequently looked upon as expensive. This does not necessarily follow. Such a herd should be maintained largely upon cheap roughages, some at least of which are unsalable. The roughages will vary in different localities, and the varieties used should be governed very largely by their availability.

Where corn silage is available, it is undoubtedly one of the very best feeds to use as the principal part of the winter ration of beef breeding cows. It is neither necessary nor advisable to feed to such cows all they will eat, but rather limit the amount to a medium ration of silage and supplement it with clover hay and other roughage such as straw or corn stover. A ration composed of eighteen pounds of silage and four pounds of clover hay per 1000-lb. cow per day, together with all the straw the cows will eat, will not only keep cows from losing in weight during the winter season, but will cause them to gain at the rate of from one to one and a quarter pounds per head per day. If silage is not available, a daily ration of ten pounds of shock corn,

four pounds of clover hay, and all the straw the cows will take will winter them satisfactorily, but not as well as the silage ration to which we have referred.

Beef breeding cows may be wintered on corn stover and straw, supplemented with a limited amount (two pounds per day per thousand pounds live weight) of clover hay. This ration contains no grain, and, while cows may be maintained on it at less cost than the previous rations, it will not prove economical for a series of years, because the thrift of the animals is not well maintained nor their milk flow sustained. A small amount of grain in the ration is a matter of very great importance. Wintering in stalk field with access to oat straw and open shed shelter is a suitable method of wintering, provided there is sufficient supply of grain in the field or added to the ration.

CHAPTER XXIII.

COST OF REARING CALVES ALLOWED TO NURSE THEIR DAMS

The question, "What does it cost to raise a 450-lb. calf?" is one which has been raised a multitude of times in the minds of the beef producers of this country. It has been raised in the East, in the corn-belt, and on the range. It requires but a very superficial study of the subject to become convinced that the cost varies widely in different sections of the country and under different systems of management. It is not our purpose to discuss the cost of range-bred calves, but rather to discuss what are commonly spoken of as native calves. Nor is it our purpose at this time to attempt to show the cost of rearing skim-milk calves, but to confine this discussion to the cost of raising calves where cows of pronounced beef breeding are maintained solely for the calves which they produce, the latter being allowed to nurse the former. In other words, these beef-breeding cows are kept for the production and rearing of one calf each annually.

Before attempting to itemize the cost of producing such calves, it will be well to discuss some of the conditions which affect such a statement. There are three principal conditions of circumstances which affect the cost of production of beef calves. They are: First, the market value of the land. Second, the natural adaptability of the land for cattle raising. Third, the grade of calves produced. The first and second items might at first thought appear to refer to about the same thing, but, as a matter of fact, they may introduce quite different conditions. For example, we can understand how some land valued at $50 per acre would be about as valuable

per acre for raising beef calves as other land valued at $100, or even more. In considering the question of the market value of the land in reference to the cost of producing calves, it is, therefore, necessary to know what makes the land valuable. If it is its exceptional adaptability for the production of beef, all well and good, but if its high value is due to its location, or its expensive equipment, these things, which may add greatly to the market value of the land, also materially add to the cost of rearing calves. Undoubtedly, there was a time when the market value of land in the corn-belt appreciated because of its discovered unusual possibilities for growing corn, which was almost exclusively used for live-stock production, and more particularly used for fattening cattle. In recent years, however, lands in the corn-belt have not risen in value primarily because of their ability to raise more corn, to feed more cattle, to buy more hogs, etc. Cattle feeding has become but an incident in the corn raising and marketing territory.

As a result of these changing conditions, it is observed that cattle production is shifting from the high-priced corn-belt farms to the cheaper lands of the East, West, North, and South. Especially is this true of the raising of feeding cattle, a subject of which the present discussion forms an important part. High-priced corn-belt farms have long since ceased to possess advantages in cattle raising as distinct from cattle fattening.

To intelligently discuss the cost of production of a beef calf it is necessary to assume that certain conditions obtain. It must be known, for example, that the land has a definite market value, upon which valuation it is reasonable to demand a fair interest. It must be assumed also that the land selected to illustrate the point in hand must be fairly well adapted for cattle raising. That is, it must produce satisfactorily a variety of grasses and clovers for pasture and hay, and corn, oats or other feeds suitable for the production of cattle. That is to say, whatever value the land possesses, the value

should rest in the land and not in its proximity to some city, town, or village, or as has been mentioned before, its value must not consist in expensive improvements that do not directly aid in cheapening the cost of producing cattle.

Suppose, as an example, we assume the land to be worth $100 per acre and sufficiently fertile and so handled that it produces a calf to 6 months of age, including the keep of the dam, to each two acres. It would seem reasonable to charge 5 per cent on the investment in lands and 7 per cent interest on cattle.

Another item which should receive some explanation is that of the grade of calves produced. It is assumed that only calves possessing a high percentage of beef blood are to be produced and that these calves possess the type and characteristics of well-bred beef calves. Calves of such breeding and permitted to nurse their dams should weigh from 400 to 450 pounds at six months of age. It is believed that a herd of cows properly handled should produce 85 per cent of calves annually, or to produce one calf would require 1.18 cows. Such cows would be valued at about $40 each. A suitable bull would cost approximately $150 and serve twenty-five cows.

With these facts known it is possible to make the following itemized statement, which is intended to show the cost of production per calf:

Five per cent interest on investment in two acres of $100 land and accompanying equipment	$10.00
Seven per cent interest on investment in 1.18 cows at $40	3.90
Seven per cent interest on investment in one twenty-fifth of a $150 bull	.42
Cost of production of winter feed and pasture, exclusive of above charges	4.00
Taxes and insurance on land and cattle, including necessary fencing repairs	3.00
Annual depreciation on 1.18 cows at $2.00	2.36

Pro rata depreciation on herd bull	.80
Four per cent mortality on valuation of stock and herd bull	2.13
Total cost	$26.61

If the calf weighs 450 pounds, it has cost approximately $6.00 per hundredweight. If it does not weigh that much it has cost more.

Were such calves to be raised on land valued at $50 instead of $100 per acre, which is not impossible, the cost of each calf could be reduced fully one-fifth. There are other items of expense which might under favorable conditions and the best practice be lessened, but the writer believes the total expense as given is under, rather than over, what might be expected in average practice. In the itemized statement no account is taken of the labor involved in caring for cows or calves, or fertilizer produced by them.

CHAPTER XXIV.

THE DUAL PURPOSE COW AND BEEF PRODUCTION

The dual-purpose cow is an established fact. It is not claimed that the type has reached permanency or that it has acquired a high degree of excellence. Numerically, from the viewpoint of the breeder of pedigreed cattle, her race is relatively insignificant.

Speaking in general, she exists on many American farms as a grade of mixed lineage, but usually showing a predominance of Shorthorn blood.

In addition to those of Shorthorn lineage, should be mentioned some very excellent representatives, both pedigreed and grades, among the Red Polled and Devon breeds. That the dual-purpose type is of late becoming more popular is believed by many who are in a position to feel the pulse of agricultural sentiment. It is not the purpose of the writer to champion the cause of the dual-purpose cow. She exists in this country and, judging from her long-continued popularity in Great Britain, she will continue to figure as a factor in American cattledom for generations to come. A partial excuse for her existence, if one is needed, is that not only she, but her offspring, have the capacity for making beef. The dual-purpose cow bears, then, at the present time, and is likely to for some years to come, a very direct relation to the beef producing industry of the United States. Bear in mind that the writer is not trying to force the dual-purpose type upon an unwilling people. He will not long hesitate, however, to advocate the general adoption of the dual-purpose type by the beef producers outside the range country if thorough investigation proves this the most profitable type. Certain it is, that the aban-

donment of beef cattle breeding and eventually of cattle feeding over a large area of the States is a problem that this generation must meet unless some practicable solution is soon found that will render the business more financially attractive. Other conditions surrounding the industry may change in such a way as to relieve the necessity for change in the type of cattle producing our beef supplies. Students of the situation do not anticipate permanent relief from outside sources.

It is because of the repeated statements of experienced beef producers and breeders of beef cattle that the future supply of beef cattle must be bred from cows that are milked, that the writer deems it essential to consider briefly the subject of this discussion, leaving the reader to adapt the facts presented to local conditions.

Some of the pertinent points for consideration are:

1. Can cows be found that will produce an ample milk flow, ample to throw them into the class of profitable dairy cows, and at the same time, when bred to bulls of beef breeding produce steers that will make, when properly fattened, a satisfactory grade of beef?

2. What average capacity for production of milk and butter fat may be reasonably expected of such cows, and the value of such products?

3. The standard of excellence possible in the steers bred from such cows and the value of the calves produced on supplemented skim-milk.

4. Knowing approximately present possibilities of production, what is the probable expense including feed and labor of accomplishing certain dual results?

5. Lastly, what are the possibilities of improvement in performance and economy of production in dual-purpose types? It does not fall within the purpose of this discussion to dwell on this latter point. It is a matter for investigators and breeders to determine. There is, of course, some limit to the development of the dual capacity. If that limit has been reached in this country,

it must be admitted that it has been reached quickly and without much concerted action upon the part of any large number of breeders.

As to the other points raised, there are some things which should be said. Definite data bearing directly upon the possibilities of profit in the handling of a dual-purpose type of cattle are scarce.

1. In the introduction, the writer has declared that individual animals of the dual-purpose type, the desirable characteristics of which are generally understood, exist.

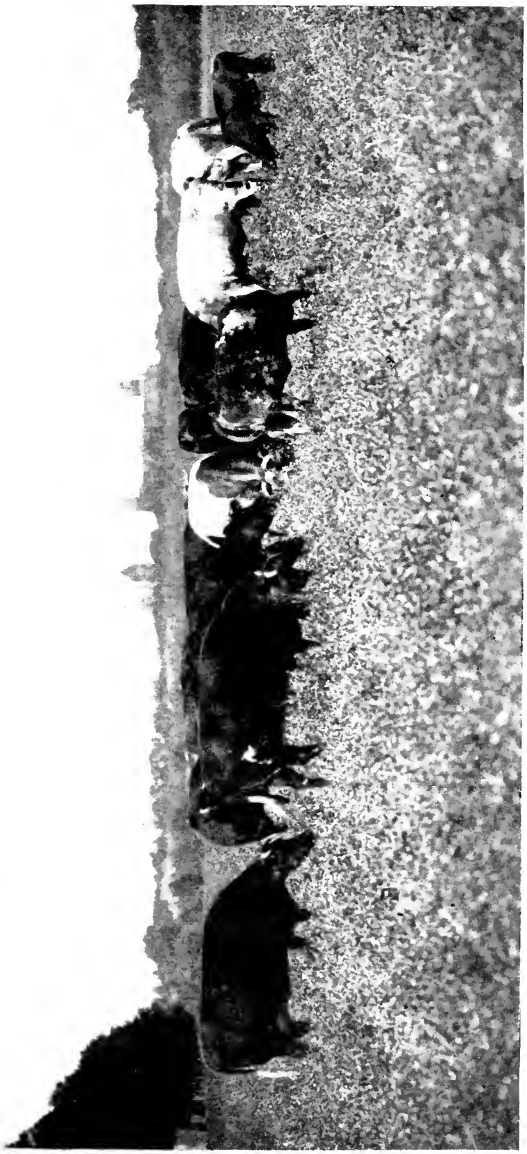
Performance of grade and registered Shorthorns at the Michigan Experiment Station, grade Shorthorns at the Wisconsin Station, and again registered Shorthorns at the Nebraska Station, to say nothing of numerous breeders and farmers throughout the country, should be sufficient to prove the possibility of dairy excellence in cows of somewhat pronounced beef type.

The Red Polled breed has also made a good account of itself at experiment stations and in the hands of farmers and breeders. The Iowa Station, as well as breeders and farmers, have fattened and marketed steers from such cows, in some instances the produce of cows with which satisfactory dairy records have been made, that have sold well up to the top of the market. While "topping the market" is not necessarily an index of the highest obtainable quality, it usually accompanies the sale of bullocks very satisfactory to the slaughterer.

2. Dairy performance.

The Kansas Station has shown that a herd of grade cows produced in one year an average of 6288.58 pounds milk, containing 251.24 pounds butter fat, per cow. The Michigan Station in Bulletin 166 published the dairy performance of a herd of twenty-seven grade cows, the average production of which was 7009 pounds milk, containing 259.91 pounds butter fat.

The writer is familiar with the type of cows used in



A group of Shorthorn breeding cows at the University of Illinois.

this latter demonstration test, and they were, with a few possible exceptions, such as would produce a good to choice grade of feeding cattle when mated to beef-bred bulls of merit. Butter fat is commonly worth at least 20 cents per pound and skim-milk 15 cents per hundredweight.

3. The Michigan Station has shown that the calf from such cows may be made to weigh 380 pounds at six months of age, when fed upon a ration of skim-milk valued at 20 cents per hundredweight and corn, oats, bran, and oil meal at prevailing prices used as supplements to the skim-milk and at a cost of $3.42 per hundredweight, not counting labor.

The items of feed and labor, including milking, in caring for the cow and calf, will vary widely in different sections. The labor involved would amount approximately to $25. The feed for the cow twelve months and the calf six, from $45 to $50.

In the above statements no account is taken of the fertilizer produced by the cow and calf and this is by no means an inconsiderable item. Nor is any interest on the investment charged. It must be admitted that in the light of available definite experimental data on the subject under discussion, it is impossible to present a very satisfactory statement, and it is not claimed that the one outlined is more than approximately correct. It will be noted that a very large item in the above expense account is for labor. This must necessarily be true when the cows are milked and the calves fed by hand.

There are those who have settled to their own satisfaction that the dual-purpose cow must yearly become a more important factor in the beef producing industry. The writer is investigating the subject.

CHAPTER XXV.

SKIM-MILK CALVES

THE SKIM-MILK CALF NOT POPULAR

The mere mention of the skim-milk calf in connection with beef production is sure to call forth a derisive smile from the majority of western and middle western cattlemen. To them the skim-milk calf means a stunted, paper skinned, pot bellied petite bovine; a fit subject for ridicule, but hardly worth bothering with in the feed lot. Nor has the western cattleman shot wide of the mark. The average skim-milk calf is not "a thing of beauty and a joy forever." Notwithstanding these facts he is with us and his number is very likely to increase. Not all skim-milk calves are bad. Occasionally a calf thus reared makes a good account of himself and demands the respect of beef purists. It may be assumed then that there is a right and a wrong way to rear skim-milk calves.

NOT ALL BAD

The Nebraska Experiment Station in Bulletin 68 reports the result of an experiment conducted primarily to show the profit of raising skim-milk calves on separator milk as compared with that derived from allowing them to nurse their dams. It is interesting to note the author's observations on these calves which are in substance as follows: At six months of age the calves that had nursed their dams could be distinguished by their better coats and rounder forms from those that had been fed on skim-milk, but at the age of one year this difference could not be detected, and stockmen unfamiliar with the individuals could not pick out the

skim-milk calves. The conclusion from this is that by careful feeding, good steers can be raised on skim-milk by using ground feed to replace the butter fat.

HOW TO RAISE A SKIM MILK CALF

It is obvious that to secure the best results in raising a calf by hand we should imitate nature's method as near as it is possible. There is a difference of opinion as to the best time to take the calf away from the cow; some advocate taking the calf away before it nurses at all, while others advise allowing the calf to nurse three or four times. This latter method is advised by the Nebraska, Michigan, and Kansas Experiment stations, where experiments with skim-milk calves have received considerable attention. It is thought that by this method the calf gets a little better start in the world and that the nursing is a benefit to the fresh cow. The only argument in favor of taking the calf away as soon as practicable after birth and before it nurses is that if taken away then, the calf can be taught to drink more readily than after it has had an opportunity to get its nourishment for a time by nursing from the udder. It is also thought by some that the cow gives up her calf at once with less grief than where she has been permitted to enjoy it for a day or so. The writer leans to the former method of management; even though it means more work for the attendant, it is better for the calf. It is possible that a compromise method advocated by some is better than either mentioned. This method is to allow the calf to nurse once and then remove from the cow. In either instance the calf must receive the first milk of the dam. It is well to let the calf get hungry after first removing from the cow, before attempting to feed it from the pail. If the calf is strong, a fast of twenty-four hours will bring the desired appetite. The calf should be fed whole milk for the first three of four weeks and three times a day. If a large calf, two quarts in the morning

and evening and one at noon should be fed; a small calf should have only three pints in the morning and three pints in the evening and a quart at noon. It is better to feed milk immediately after being drawn from the cow. At the end of the third or fourth week, the substitution of skim-milk for whole milk may be begun, as also feeding twice instead of three times a day. This should be brought about very gradually. The first time any substitution of skim-milk for whole milk is made, let one half pint of skim-milk replace an equal amount of whole milk. The next time, feed a pint and so on, making a half pint additional substitution with each feed. By following this method from ten days to two weeks will be required to get the calf safely accustomed to skim-milk. A teaspoonful of ground flax mixed in the skim-milk is excellent. If any tendency to scours occurs, a small amount of blood flour mixed in the milk will check it. After the change has been effected, the skim-milk and the ground flax may be very gradually increased, until at the age of four months the calf should receive a heaping tablespoonful of flax meal and five quarts of milk twice each day. Do not forget that ten to twelve quarts of skim-milk per day is a full feed for a calf five to six months of age. When the calf is three to four weeks old, it should have an opportunity to learn to eat oats, bran, and corn. Professor Shaw of Michigan recommends the following mixture for this purpose: Cornmeal 3 parts, oats 3 parts, and bran 1 part, by weight. One part oil meal should be added to this if no ground flax is fed as suggested above. The calves may be induced to eat this mixture by dropping a tablespoonful of it into the pail after the milk is gone. Do not sicken them by feeding too liberally. They should also be encouraged to take a little silage and nicely cured clover or alfalfa hay. As to the amount of concentrates fed, Professor Shaw says: "In general, about ¾ pound concentrates per 100 pounds live weight, varying some, of course, with individuals." As a general practice, we strongly advise

against mixing grain with skim-milk for calf feeding. They should be fed separate as advised with the possible exception of the small amount of flax meal mentioned. One essential point in calf rearing is frequently overlooked, namely, the supplying of an ample quantity of fresh clean water within the reach of the calves at all times. Some use a hog waterer for this purpose.

The following from Professor Haecker of Minnesota is well worth careful reading:

"It has been the general opinion among farmers that separator skim-milk was not a strong or nutritious feed and that a large mess must be given to make up in quantity what they supposed it lacked in quality, and the result was that calves were overfed, and indigestion would be produced, which was followed by scours and bloat.

"If directions are strictly followed, the calf will always act more hungry after taking its meal than it did before, but it is better thus than to give it a larger mess and then have a case of scours or bloat on your hands. Each calf should be fed by itself out of a clean tin pail, which should be washed and scalded after each feeding just as thoroughly and carefully as one does the milk pails. Place the calves in small stanchions while they are being fed, so they will not get into the habit of sucking each other. Have the little manger in front of them wide enough so an ordinary tin pail, containing the mess of milk, can be set into it. Have partitions placed in the manger, and when it has taken the milk, take out the pail, and if the calf is old enough to eat oats or bran, throw in about a tablespoonful and it will soon get into the habit of chewing the oats as soon as it has taken the milk. For about that time it wants to do something, and if it is not confined in a stanchion or tied out of reach of another calf, it will amuse itself by sucking its neighbor's ears. The bottom of the manger should be a dressed board about ten inches wide, and should be so

adjusted that it can be taken out once a week and scrubbed with hot water and soap; for the manger must be kept absolutely sweet and clean."

Bulletin 97 of the Kansas Station makes this pertinent observation: "Finally, remember that the calf is a baby and give it the kindness and care due every baby. The better a calf likes you the more it will gain. Pet it. Keep its pen and yard dry and comfortable; keep it warm in cold weather and give it cool shade in summer."

PART III.

ELEMENTARY PRINCIPLES OF STOCK FEEDING[1]

GENERAL DISCUSSION

Familiarity with the science, or the principles governing the processes, of stock breeding and stock feeding is highly desirable from the standpoint of the stock raiser. It is not to be asserted that such knowledge is absolutely necessary, for it is well known that we have many successful stock breeders and stock feeders who know little, if anything, about the principles of the enterprise to which they look with confidence for a competency. Success in farming is dependent more upon a thorough familiarity with the art or practice than with the science or fundamental principles of the business. The art is the practice of stock feeding. Successful stock feeding practice may be acquired from personal contact and experience, and by carefully observing the methods of our most successful feeders. Such experience is acquired, at best, but slowly, and often at great expense. However, a knowledge of the scientific principles of stock feeding makes it possible for the inexperienced to learn the art more quickly, at less expense, and withal more thoroughly. Fewer mistakes will be made in stock feeding practice by men who are thoroughly familiar with the principles of the business than by those ignorant of the same. Mistakes in feeding practice are more serious now than formerly, and will become more serious with the lapse of time, because competition will be keener, land and food-stuffs more valuable, and labor more expensive.

[1] By the author, in "Practical Farming and Gardening." Rand, McNally & Co., Chicago and New York, Publishers.

Professor Brooks of Massachusetts well says: "Some knowledge of the composition of animal products and of foods; some knowledge of the laws of nutrition, and of the facts discovered by scientific men regarding the most economical production of meat, of fat, of milk, and work, will help even the best practical feeder. Such knowledge will not render the exercise of the observing faculties and of the judgment the less important. It will rather sharpen the one and broaden the other."

Chemistry of Stock Feeding.—In an attempt to discover principles of stock feeding, investigators have given much attention to the chemical problems, neglecting to some extent, perhaps, the physical and the physiological factors involved. It is a pardonable oversight, since investigations tending to throw light upon the subject should begin with a study of the chemical substances necessary for the development of plant and animal life. The existence of our farm animals is dependent upon plant life. There must, therefore, be certain elements or compounds in the plant that contribute to the upbuilding of animal tissues.

Of the seventy recognized chemical elements which in their infinite combinations form all organic and inorganic substances, only fifteen are involved in plant life, viz., calcium, carbon, chlorine, fluorine, hydrogen, iron, magnesium, manganese, nitrogen, oxygen, potassium, phosphorus, silicon, sodium, and sulphur.

In making application of the chemistry of plant and animal bodies to the subject of stock feeding it is seldom necessary to deal directly with these elements, but rather with certain compounds made up through various combinations of these elements. These classes of compounds are practically the same in plant and animal bodies and are usually referred to as ash, crude fiber, fat, nitrogen-free extract, protein, and water. The percentages of crude fiber and nitrogen-free extract are commonly grouped together and referred to as carbohydrates.

We reproduce a table from Doctor Jordan's "The Feeding of Animals,"[1] which will aid the reader to understand the relation between the chemical elements and the chemical compounds to which we have referred.

		Compounds	Elements
All Vegetable or Animal Matter	Incombustible or Inorganic Matter	Water	Oxygen, Hydrogen
		Ash	Oxygen, Sulphur, Chlorine, Phosphorus, Silicon. Fluorine. Potassium, Sodium, Calcium, Magnesium, Iron, Manganese
	Combustible or Organic Matter	Protein	Carbon, Oxygen, Hydrogen, Nitrogen, Sulphur (generally), Phosphorus (sometimes), Iron (in a few cases)
		Carbohydrates and Fats	Carbon, Oxygen, Hydrogen

COMPOSITION OF FOOD STUFFS.

It is necessary, first of all, that the stock raiser recognize the fact that the elements with which he fertilizes his soil will reappear later on, in a measure large or small, in the bodies of the animals he fits for market. These elements will have suffered two transformations in the meantime, being assimilated, first, by the plant, and second, by the animal. All the undigested portion of the animal's food will have been returned to the land as fertilizer, and all the digested portion as well, except so much as has been permanently incorporated in the ani-

[1] New York: The Macmillan Co.

mal body, supposing, of course, that all the manure, including the urine, will be returned to the land. In fixing on the crops to be raised and the feeds to be bought, therefore, the intelligent farmer has in mind (1) availability for the purpose desired (depending on composition and digestibility) and (2) fertilizer value.

Water and Dry Matter.—All food-stuffs contain a considerable proportion of water. The residue is included under the general term "dry matter." A proper ration for a farm animal will contain a quantity of dry substance which is practically uniform for animals of the same species, type, age, and condition.

Because water is abundant in plant and animal life, we should not conclude that it is valueless, but rather, as in the case of carbohydrates, that it is essential. The leading functions of water related to animal life are as a solvent and distributor of other compounds, while it gives elasticity and firmness as well to animal tissues. Investigations as to the percentage of water in animal bodies under normal conditions have shown that usually more than 50 per cent of the total weight of an animal is water, the percentage varying with the age, condition, and species of animal.

Ash and Organic Matter.—The dry matter of a food is subdivided into *ash* (inorganic, or mineral components) and *organic matter.* The mineral substance is called "ash" because it alone remains when the organic matter is driven off by burning.

It will be observed that the constituent in plants and animals containing the greatest number of chemical elements is ash, and yet ash seldom constitutes more than one-tenth of the animal, and still less of the plant, seldom exceeding, in general, one-twentieth. Clover hay contains a relatively high percentage of ash, while corn yields only a small amount. In the former case there are about 6.2 pounds, and in the latter 1.5 pounds ash per hundredweight. While the relative amount of ash in all food-stuffs is small, it is absolutely necessary to

promote both animal and vegetable growth. As a matter of fact, little attention has been paid to the ash constituents of plants intended for animal food, largely because there has seemingly been a sufficient supply in most food-stuffs. Recent investigations reveal the fact that the ash constituent in food-stuffs is more closely related to commercial production of animal products than was formerly supposed.

Protein, Fat, and Carbohydrates.—The organic components of feeding stuffs fall into three groups: Proteids, fats, and carbohydrates.

Protein.—The compounds of vegetable and animal structure containing nitrogen are in general terms called protein. Compounds of this class vary much in their nature, composition, and relative feeding value. They have one thing in common, namely, the possession of nitrogen. They are, therefore, frequently spoken of as nitrogenous compounds. The most expensive constituent in fertilizers is nitrogen; likewise the most costly food-stuffs are those possessing the highest percentage of digestible protein. Whatever other functions protein may have, its chief one is that of a flesh (lean meat) former.

Carbohydrates.—The carbohydrates are of two kinds, fiber and nitrogen-free extract. The fiber (composed principally of cellulose) is the hard, woody framework of the plant. The portion available for nutrition appears to be digested in the intestines. Nitrogen-free extract includes the more easily digested starches, sugars, and gums. The carbohydrates are the cheapest food-sources of heat, energy, and fat. Since their function is the same as that of the digestible fats found in feeding-stuffs, and since the fats are about 2¼ times as effective as the carbohydrates, it is customary for the sake of simplicity to reckon them together. The fat content of a feeding-stuff is multiplied by 2¼ and the product is added to the amount of carbohydrates present.

Carbon, oxygen, and hydrogen — elements which may

be derived from air and water — are the only elements found in the carbohydrates; they are frequently spoken of as nitrogen-free compounds.

No other class of chemical compounds comprises so large a part of stock foods as the carbohydrates. In some cases, as in certain varieties of hay and grain, they comprise 80 per cent of the dry matter. While abundant in most food-stuffs, they are nevertheless a valuable constituent, as being the chief source of energy and fat.

Fat, or Ether-Extract.—The percentages indicated in the column headed "Ether Extract" in the table following include several compounds, mainly, however, fats that are soluble in ether. The value of the ether-extract in a given food-stuff depends largely upon its nature.

DIGESTION AND GROWTH

Since only a part is digested, not all the nutrients in food-stuffs nourish the animal body. We speak of a given food-stuff as containing a certain number of pounds of protein per hundredweight. While this knowledge may in certain instances be useful to the feeder, the important thing to know is, how much available protein is present and the character of the feed that contains it.

Conditions Affecting Digestion.—In the processes of digestion, such portions of the food nutrients as are digestible are converted into a form which may be readily taken up by the absorbent vessels of the stomach and intestines. The undigested portions of food-stuffs are believed, in certain instances, to serve the purpose of distending the stomach and intestines. In general, a much higher percentage of the food nutrients in concentrates is digested than in roughages containing a large amount of crude fiber. Other conditions, also, affect the relative digestibility of nutrients in food-stuffs: (1) Certain species of animals, such as cattle, sheep, and other ruminants, digest a higher percentage of crude

fiber than do others, for example, horses. (2) Not only is there a difference in classes of animals as to their digestive capacities, but there are differences in animals of the same class in this regard. In other words, some animals are more economical producers of animal products than others.

Processes of Digestion and Assimilation.—To be of any use, the digested food must be assimilated by the animal. The process of assimilation consists in the taking up or absorption of digested food particles, which are conveyed by the blood to every part of the animal. A general knowledge of where the various food nutrients are digested is desirable; hence, a brief reference to the subject seems pertinent.

The changes which take place in food during the processes of digestion are mainly chemical; but the first change or process is a mechanical one — that of mastication, the process during which the food is broken or ground up into fine particles, rendering it more susceptible to the chemical action of various juices with which the food particles come in contact during its passage through the alimentary canal. The only food nutrient that is partially or wholly digested by the action of the digestive ferments with which the masticated food is brought in contact in the mouth is a portion of the starch constituent of carbohydrates. Whether the amount digested is large or small depends upon the thoroughness of mastication and the length of time the food remains in the mouth. Under ordinary conditions, since the food remains there but a short time, the amount of starch digested is small.

The remainder of the digestible starch is digested mainly in the intestines. In general, then, we may say that carbohydrates are digested partly in the mouth, but mainly in the intestines.

The stomach, by the action of the different ferments in the gastric juice, the digestive agent with which the food comes in contact in the stomach, digests the greater

part of the proteids. The remaining digestible proteids are digested in the intestines. Fats and oils are mainly digested in the intestines.

COMPOUNDING OF RATIONS

Agricultural investigators can not hope to attain to mathematically exact results. Food constituents vary from sample to sample; digestive power varies from animal to animal. These variations, however, are not great, and hence not serious as disturbing factors. The farmer must concern himself with average results to meet individual conditions and requirements.

TABLE I. AVERAGE DIGESTIBLE NUTRIENTS IN AMERICAN FEEDING STUFFS

The following table of average digestible nutrients is reproduced by permission from that valuable work, "Feeds and Feeding," by Dean and Director W. A. Henry, of the Wisconsin Experiment Station.

Name of feed	Dry matter in 100 pounds	Digestible nutrients in 100 pounds			Fertilizing constituents in 1000 pounds.		
		Protein	Carbo-hydrates	Ether extract	Nitrogen	Phosphoric acid	Potash
CONCENTRATES	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Corn, all analyses.	89.1	7.9	66.7	4.3	18.2	7.0	4.0
Dent Corn.....	89.4	7.8	66.7	4.3	16.5	....	....
Flint corn.....	88.7	8.0	66.2	4.3	16.8	....	....
Sweet corn.....	91.2	8.8	63.7	7.0	18.6	....	....
Corn cob	89.3	0.4	52.5	0.3	5.0	.6	6.0
Corn and cob meal	84.9	4.4	60.0	2.9	14.1	5.7	4.7
Corn bran	90.9	7.4	59.8	4.6	16.3	12.1	6.8
Gluten meal.....	91.8	25.8	43.3	11.0	50.3	3.3	0.5
Germ meal.....	89.6	9.0	61.2	6.2	26.5	8.0	5.0
Starch refuse.....	91.8	11.4	58.4	6.5	22.4	7.0	5.2
Grano-gluten.....	94.3	26.7	38.8	12.4	49.8	5.1	1.5
Hominy chops....	88.9	7.5	55.2	6.8	16.3	9.8	4.9
Glucose meal.....	91.9	30.3	35.3	14.5	57.7	....	....
Sugar meal.....	93.2	18.7	51.7	8.7	36.3	4.1	0.3
Starch feed, wet..	34.6	5.5	21.7	2.3	9.8	1.0	1.0
Wheat.....	89.5	10.2	69.2	1.7	23.6	7.9	5.0
High-grade flour..	87.6	8.9	62.4	0.9	18.9	2.2	1.5
Low-grade flour ..	87.6	8.2	62.7	0.9	28.9	5.6	3.5

Name of feed	Dry matter in 100 pounds	Digestible nutrients in 100 pounds			Fertilizing constituents in 1000 pounds		
		Protein	Carbohydrates	Ether extract	Nitrogen	Phosphoric acid	Potash
CONCENTRATES	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Dark feeding flour	90.3	13.5	61.3	2.0	31.8	21.4	10.9
Wheat bran	88.1	12.2	39.2	2.7	26.7	28.9	16.1
Wheat bran, spring wheat	88.5	12.9	40.1	3.4	....	....	....
Wheat bran, winter wheat	87.7	12.3	37.1	2.6	....	....	....
Wheat shorts	88.2	12.2	50.0	3.8	28.2	13.5	5.9
Wheat middlings	87.9	12.8	53.0	3.4	26.3	9.5	6.3
Wheat screenings	88.4	9.8	51.0	2.2	24.4	11.7	8.4
Rye	88.4	9.9	67.6	1.1	17.6	8.2	5.4
Rye bran	88.4	11.5	50.3	2.0	23.2	22.8	14.0
Rye shorts	90.7	11.9	45.1	1.6	18.4	12.6	8.1
Barley	89.1	8.7	65.6	1.6	15.1	7.9	4.8
Malt sprouts	89.8	18.6	37.1	1.7	35.5	14.3	16.3
Brewers' grains, wet	24.3	3.9	9.3	1.4	8.9	3.1	0.5
Brewers' grains, dried	91.8	15.7	36.3	5.1	36.2	10.3	0.9
Oats	89.0	9.2	47.3	4.2	20.6	8.2	6.2
Oatmeal	92.1	11.5	52.1	5.9	23.5	....	....
Oat feed or shorts	92.3	12.5	46.9	2.8	17.2	9.1	5.3
Oat dust	93.5	8.9	38.4	5.1	21.6	....	....
Oat hulls	90.6	1.3	40.1	0.6	5.2	2.4	5.2
Rice	87.6	4.8	72.2	0.3	10.8	1.8	0.9
Rice hulls	91.8	1.6	44.5	0.6	5.8	1.7	1.4
Rice bran	90.3	5.3	45.1	7.3	7.1	2.9	2.4
Rice polish	90.0	9.0	56.4	6.5	19.7	26.7	7.1
Buckwheat	87.4	7.7	49.2	1.8	14.4	4.4	2.1
Buckwheat hulls	86.8	2.1	27.9	0.6	4.9	0.7	5.2
Buckwheat bran	89.5	7.4	30.4	1.9	36.4	17.8	12.8
Buckwheat shorts	88.9	21.1	33.5	5.5	....	....	....
Buckwheat middlings	87.3	22.0	33.4	5.4	42.8	21.9	11.4
Sorghum seed	87.2	7.0	52.1	3.1	14.8	8.1	4.2
Broom-corn seed	85.9	7.4	48.3	2.9	16.3	....	....
Kaffir corn	84.8	7.8	57.1	2.7	....	....	....
Millet	86.0	8.9	45.0	3.2	20.4	8.5	3.6

Name of feed	Dry matter in 100 pounds	Digestible nutrients in 100 pounds			Fertilizing constituents in 1000 pounds		
		Protein	Carbohydrates	Ether extract	Nitrogen	Phosphoric acid	Potash
CONCENTRATES	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Flax seed	90.8	20.6	17.1	29.0	36.1	13.9	10.3
Linseed meal, old process	90.8	29.3	32.7	7.0	54.3	16.6	13.7
Linseed meal, new process	89.9	28.2	40.1	2.8	57.8	18.3	13.9
Cottonseed	89.7	12.5	30.0	17.3	31.3	12.7	11.7
Cottonseed meal	91.8	37.2	16.9	12.2	67.9	28.8	8.7
Cottonseed hulls	88.9	0.3	33.1	1.7	6.9	2.5	10.2
Cocoanut meat	89.7	15.6	38.3	10.5	32.8	16.0	24.0
Palm-nut meal	89.6	16.0	52.6	9.0	26.9	11.0	5.0
Sunflower seed	92.5	12.1	20.8	29.0	22.8	12.2	5.6
Sunflower seed cakes	91.8	31.2	19.6	12.8	55.5	21.5	11.7
Peanut meal	89.3	42.9	22.8	6.9	75.6	13.1	15.0
Rape-seed meal	90.0	25.2	23.7	7.5	49.6	20.0	13.0
Peas	89.5	16.8	51.8	0.7	30.8	8.2	9.9
Soja (soy) bean	89.2	29.6	22.3	14.4	53.0	18.7	19.9
Cow-pea	85.2	18.3	54.2	1.1	33.3	....	....
Horse bean	85.7	22.4	49.3	1.2	40.7	12.0	12.9
ROUGHAGES							
FODDER CORN							
Fodder corn, green	20.7	1.0	11.6	0.4	4.1	1.5	3.3
Fodder corn, field-cured	57.8	2.5	34.6	1.2	17.6	5.4	8.9
Corn stover, field-cured	59.5	1.7	32.4	0.7	10.4	2.9	14.0
FRESH GRASS							
Pasture grasses (mixed)	20.0	2.5	10.2	0.5	9.1	2.3	7.5
Kentucky blue grass	34.9	3.0	19.8	0.8	....	....	....
Timothy, different stages	38.4	1.2	19.1	0.6	4.8	2.6	7.6
Orchard grass, in bloom	27.0	1.5	11.4	0.5	4.3	1.6	7.6
Red-top, in bloom	34.7	2.1	21.2	0.6	....	....	....
Oat fodder	37.8	2.6	18.9	1.0	4.9	1.3	3.8
Rye fodder	23.4	2.1	14.1	0.4	3.3	1.5	7.3
Sorghum	20.6	0.6	12.2	0.4	2.3	0.9	2.3
Meadow fescue, in bloom	30.1	1.5	16.8	0.4	....	....	....

Name of feed	Dry matter in 100 pounds	Digestible nutrients in 100 pounds			Fertilizing constituents in 1000 pounds		
		Protein	Carbohydrates	Ether extract	Nitrogen	Phosphoric acid	Potash
CONCENTRATES	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Hungarian grass	28.9	2.0	16.0	0.4	3.9	1.6	5.5
Green barley	21.0	1.9	10.2	0.4	....	....	....
Peas and oats	16.0	1.8	7.1	0.2	....	....	....
Peas and barley	16.0	1.7	7.2	0.2	....	....	....
HAY.							
Timothy	86.8	2.8	43.4	1.4	12.6	5.3	9.0
Orchard grass	90.1	4.9	42.3	1.4	13.1	4.1	18.8
Red-top	91.1	4.8	46.9	1.0	11.5	3.6	10.2
Kentucky blue grass	78.8	4.8	37.3	2.0	11.9	4.0	15.7
Hungarian grass	92.3	4.5	51.7	1.3	12.0	3.5	13.0
Mixed grasses	87.1	5.9	40.9	1.2	14.1	2.7	15.5
Rowen (mixed)	83.4	7.9	40.1	1.5	16.1	4.3	14.9
Meadow fescue	80.0	4.2	43.3	1.7	9.9	4.0	21.0
Soja bean hay	88.7	10.8	38.7	1.5	23.2	6.7	10.8
Oat hay	91.1	4.3	46.4	1.5	....	...	....
Marsh or swamp hay	88.4	2.4	29.9	0.9	....	....	....
Marsh or swamp hay	92.1	3.5	44.7	0.7	....	....	....
White daisy	85.0	3.8	40.7	1.2	....	....	....
STRAW							
Wheat	90.4	0.4	36.3	0.4	5.9	1.2	5.1
Rye	92.9	0.6	40.6	0.4	4.6	2.8	7.9
Oat	90.8	1.2	38.6	0.8	6.2	2.0	12.4
Barley	85.8	0.7	41.2	0.6	13.1	3.0	20.9
Wheat chaff	85.7	0.3	23.3	0.5	7.9	7.0	4.2
Oat chaff	85.7	1.5	33.0	0.7	....	....	....
FRESH LEGUMES							
Red clover, different stages	29.2	2.9	14.8	0.7	5.3	1.3	4.6
Alsike, bloom	25.2	2.7	13.1	0.6	4.4	1.1	2.0
Crimson clover	19.1	2.4	9.1	0.5	4.3	1.3	4.9
Alfalfa	28.2	3.9	12.7	0.5	7.2	1.3	5.6
Cow-pea	16.4	1.8	8.7	0.2	2.7	1.0	3.1
Soja bean	24.9	3.2	11.0	0.5	2.9	1.5	5.3
LEGUME HAY AND STRAW.							
Red clover, medium	84.7	6.8	35.8	1.7	20.7	3.8	22.0
Red clover, mammoth	78.8	5.7	32.0	1.9	22.3	5.5	12.2

Name of feed	Dry matter in 100 pounds	Digestible nutrients in 100 pounds			Fertilizing constituents in 1000 pounds		
		Protein	Carbohydrates	Ether extract	Nitrogen	Phosphoric acid	Potash
CONCENTRATES	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Alsike clover	90.3	8.4	42.5	1.5	23.4	6.7	22.3
White clover	90.3	11.5	42.2	1.5	27.5	5.2	18.1
Crimson clover	90.4	10.5	34.9	1.2	20.5	4.0	13.1
Alfalfa	91.6	11.0	39.6	1.2	21.9	5.1	16.8
Cow-pea	89.3	10.8	38.6	1.1	19.5	5.2	14.7
Soja bean straw	89.9	2.3	40.0	1.0	17.5	4.0	13.2
Pea-vine straw	86.4	4.3	32.3	0.8	14.3	3.5	10.2
SILAGE							
Corn	20.9	0.9	11.3	0.7	2.8	1.1	3.7
Clover	28.0	2.0	13.5	1.0	....	....	....
Sorghum	23.9	0.6	14.9	0.2	....	....	....
Alfalfa	27.5	3.0	8.5	1.9	....	....	....
Grass	32.0	1.9	13.4	1.6	....	....	....
Cow-pea vine	20.7	1.5	8.6	0.9	....	....	....
Soja bean	25.8	2.7	8.7	1.3	....	....	....
Barn-yard millet and soja bean	21.0	1.6	9.2	0.7	....	....	....
Corn and soja bean	24.0	1.6	13.0	0.7	....	....	....
ROOTS AND TUBERS							
Potato	21.1	0.9	16.3	0.1	3.2	1.2	4.6
Beet, common	13.0	1.2	8.8	0.1	2.4	0.9	4.4
Beet, sugar	13.5	1.1	10.2	0.1	2.2	1.0	4.8
Beet, mangel	9.1	1.1	5.4	0.1	1.9	0.9	3.8
Flat turnip	9.5	1.0	7.2	0.2	1.8	1.0	3.9
Ruta-baga	11.4	1.0	8.1	0.2	1.9	1.2	4.9
Carrot	11.4	0.8	7.8	0.2	1.5	0.9	5.1
Parsnip	11.7	1.6	11.2	0.2	1.8	2.0	4.4
Artichoke	20.0	2.0	16.8	0.2	2.6	1.4	4.7
MISCELLANEOUS							
Cabbage	15.3	1.8	8.2	0.4	3.8	1.1	4.3
Spurry	20.0	1.5	9.8	0.3	3.8	2.5	5.9
Sugar-beet leaves	12.0	1.7	4.6	0.2	4.1	1.5	6.2
Pumpkin, field	9.1	1.0	5.8	0.3	....	....	....
Pumpkin, garden	19.2	1.4	8.3	0.8	1.1	1.6	0.9
Prickly comfrey	11.6	1.4	4.6	0.2	4.2	1.1	7.5
Rape	14.0	1.5	8.1	0.2	4.5	1.5	3.6
Acorns, fresh	44.7	2.1	34.4	1.7	....	....	....
Dried blood	91.5	52.3	.0	2.5	135.0	13.5	7.7
Meat scrap	89.3	66.2	.3	13.7	113.9	7.0	1.0

Name of feed	Dry matter in 100 pounds	Digestible nutrients in 100 pounds			Fertilizing constituents in 1000 pounds		
		Protein	Carbohydrates	Ether extract	Nitrogen	Phosphoric acid	Potash
CONCENTRATES	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Dried fish	89.2	44.1	.0	10.3	77.5	120.0	2.0
Beet pulp	10.2	0.6	7.3	....	1.4	0.2	0.4
Beet molasses	79.2	9.1	59.5	.0	14.6	0.5	56.3
Cow's milk	12.8	3.6	4.9	3.7	5.3	1.9	1.8
Cow's milk, colostrum	25.4	17.6	2.7	3.6	28.2	6.6	1.1
Skim-milk, gravity	9.6	3.1	4.7	0.8	5.6	2.0	1.9
Skim-milk, centrifugal	9.4	2.9	5.2	0.3	5.6	2.0	1.9
Buttermilk	9.9	3.9	4.0	1.1	4.8	1.7	1.6
Whey	6.6	0.8	4.7	0.3	1.5	1.4	1.8

FEEDING STANDARDS FOR FARM ANIMALS

From Henry's "Feeds and Feeding."

"The standards are arranged to meet the requirements of beef cattle under normal conditions. The statements in the standards should not be accepted as absolute, but rather as data of a helpful nature, to be varied in practice as circumstances suggest.

"The statements in the column headed 'Dry Matter,' should be regarded as approximate only, since the digestive tract of the animal readily adapts itself to variations of ten per cent or more from the standard of volume.

"The column headed, 'Sum of Nutrients,' combines the data of the three preceding columns, the ether extract being multiplied by 2.4 before adding. In the first column of this division of the table, marked 'Crude Fiber = 1,' all the digestible nutrients are included. In the second division, marked 'Crude Fiber = ½,' it is assumed that 30 per cent of the digestible non-nitrogenous nutrients consists of crude fiber, and one-half of this, or 15 per cent, is deducted. This deduction should be

made in the case of rations containing much coarse forage.

"The standards are for animals of normal size. Those of small breeds will require somewhat more nutrients, amounting in some cases to .3 of a pound of nitrogenous and 1.5 pounds of non-nitrogenous digestible nutrients daily for 1000 pounds of live weight of animals.

"The different standards given for the same class of animals according to performance illustrate the manner and direction in which desirable changes should be made.

"In considering the fattening standards the student should bear in mind that the most rapid fattening is usually the most economical, so that the standards given may often be profitably increased.

. . . . . .

"The standards for growing animals contemplate only a moderate amount of exercise; if much is taken, add 15 per cent — mostly non-nitrogenous nutrients — to the ration. If no exercise is taken, deduct 15 per cent from the standard."

Animal.	Per day per 1000 pounds live weight.						
	Dry matter.	Digestible Nutrients.					Nutritive ratio, 1:
		Protein.	Carbohydrates.	Ether extract.	Sum of nutrients. Crude Fiber. =1	Sum of nutrients. Crude Fiber. =½	
FATTENING CATTLE.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb	Lb.
First period	30	2.5	15.0	0.5	18.7	15.6	6.5
Second period	30	3.0	14.5	0.7	19.2	17.0	5.4
Third period	26	2.7	15.0	0.7	19.4	17.2	6.2
GROWING CATTLE. BEEF BREEDS.							
Age in months. Av. live wt. per head, lbs.							
2–3 150	23	4.2	13.0	2.0	20.0	21.5	4.2
3–6 330	24	3.5	12.8	1.5	19.9	19.0	4.7
6–12 550	25	2.5	13.2	0.7	17.4	15.8	6.0
12–18 750	24	2.0	12.5	0.5	15.7	13.9	6.8
18–24 950	24	1.8	12.0	0.4	14.8	13.2	7.2

In examining any ration to ascertain how nearly it conforms to the standard, and what modifications, if any, are needful, attention must be paid to three points:

(1) Total amount of dry matter.

(2) Amount of digestible protein.

(3) Amount of digestible carbohydrates.

COMPUTING A "BALANCED RATION."

By the term "balanced ration" is meant a ration in which the digestible protein is in the proper proportion to the digestible carbohydrates and fats. This relation varies with the various classes of animals, and in the same class depends on the age of the animal, whether the animal is growing, fattening, producing milk, or working. By means of tables showing the digestible nutrients contained in feed stuffs and the amounts of each of the classes of foods required by an animal of given weight in a certain condition, it is possible to compound a ration which is, for that animal, a balanced ration.

To illustrate the method of balancing a ration, suppose that a steer in the first period of fattening is receiving a ration consisting of 15 pounds of corn stover and 20 pounds of crushed corn daily. By referring to Table I. and multiplying the number of pounds of the three classes of foods (protein, carbohydrates, and ether extract or fat) in a pound of the food-stuffs that are being used by the number of pounds that are given the animal, we will find that the steer is receiving the following amounts of dry matter, proteids, carbohydrates, and fats:

	Dry matter.	Protein.	Carbo-hydrates.	Ether extract.
Corn stover, 15 lb.	8.92	0.25	4.86	0.105
Corn (whole or crushed) 20 lb..	17.82	1.58	13.34	0 86
Total	26.74	1.83	18.20	0.965
Required by Standard	30.00	2.50	15.00	0.50

The figures in the last line show the amounts that German investigators have found to be necessary for a 1000-lb. steer in the first period of fattening. By comparing these figures with those in the line above, which represent the amounts that the animal is actually getting, it will be seen that he is getting too much carbohydrates and fat and not enough dry matter and protein.

In order to balance up the ration it will be necessary to substitute some foods that contain less carbohydrates and more protein. By substituting 15 pounds of clover hay for the corn stover, and cutting the corn ration down to 13 pounds, the ration will be composed as follows:

	Dry matter.	Protein.	Carbohydrates.	Ether extract.
Clover hay, 15 lb.	12.705	1.02	5.37	0.25
Corn, 13 lb.	11.583	1.02	8.67	0.55
Total.	24.288	2.04	14.04	0.80

It is seen that this ration is lacking in dry matter, protein, and carbohydrates, and has too much fat. By adding two pounds of linseed oil meal (old process) we have the ration as follows:

	Dry matter.	Protein.	Carbohydrates.	Ether extract.
Clover hay, 15 lb.	12.705	1.02	5.37	0.25
Corn, 13 lb.	11.583	1.02	8.67	0.55
Oilmeal, 2 lb. . . .	1.816	.58	0.65	0.14
Total.	26.10	2.62	14.69	0.94

Although this ration is still somewhat deficient in dry matter and has an excessive amount of fat, the protein and carbohydrates are present in amounts approximately as called for by the standard. Little attention is paid to the fat in a ration for fattening animals, as there is ordinarily more than is required, the essential point being to get the protein and carbohydrates in the

right proportion. While the ration, as in this case, may possess sufficient digestible nutrients in proper proportion it may still need revision on account of a lack of palatability, or the proportion of roughage to concentrates may be too large. For the more advanced stages of fattening, this ration should be revised, so that less roughage and more concentrates are used.

[1] The "Nutritive Ratio" of a food-stuff or a ration is the relation that exists between the quantity of digestible protein and the quantity of digestible carbohydrates and fat which it contains. Thus, if 100 pounds of brewer's grains contain 15 pounds of digestible protein and 45 pounds of digestible carbohydrates and fat, the nutritive ratio is expressed thus:

Protein is to Carbohydrates and Fat as 15 is to 45, or, Protein is to Carbohydrates and Fat as 1 is to 3.

Or, written mathematically, Protein: Carbohydrates + Fat : : 1 : 3.

To find the nutritive ratio, then, of a feeding-stuff — that is, to find how many pounds or what fraction of a pound of digestible carbohydrates and fat it contains for each pound of digestible protein — we divide its digestible carbohydrates and fat content by its digestible protein content. The medium ratios lie between 1 part protein to 5½ parts carbohydrates and fat (1 : 5.5) and 1 part protein to 8 parts carbohydrates and fat (1 : 8.0). If the carbohydrates largely predominate, the ratio is said to be wide; if the proportion of protein is above the medium, the ratio is said to be narrow. Thus, timothy hay, with a nutritive ratio of 1 : 16.6, makes a wide ration; vetch hay (1:3.2) a narrow one.

Narrow Nutritive Ratio.—The following common and commercial food-stuffs are relatively high in digestible protein and low in digestible carbohydrates:

Concentrates.—Wheat bran, linseed oil meal, wheat

[1] By the author, in "Practical Farming and Gardening." Rand, McNally & Co., Chicago.

middlings, cottonseed meal, gluten meal, pea meal, cow-peas, and soy beans.

Roughage.—Clover, alfalfa, cow-pea, and vetch hay.

Wide Nutritive Ratio.—The following food-stuffs are relatively high in digestible carbohydrates and low in digestible protein:

Concentrates.—Rye, corn, cornmeal, and corn and cob meal.

Roughage.—Timothy, oat, red-top, millet, and Hungarian grass hays, and corn stover.

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